ENGINEERING NEWS.

ENGINEERING NEWS

AND

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ENGINEERING NEWS.

THE NORTHERN PACIFIC R. R. Co. is now reported to be considering an extension to the Pacific coast, via the Great Northwest Central R. R., negotiations for the purchase of which are now in progress. The Great Northwest Central R. R. was projected to run from Brandon, Man., northwest through the Saskatchewan Valley to Battleford, N. W. T. The Northern Pacific will soon have an entrance into Brandon by means of the Northern Pacific & Manitoba R. R. now under construction, and the purchase of the Great Northwest Central would extend the line well on towards the coast when completed. The route chosen for the extension follows the old "Mackenzie" survey for the Canadian Pacific R. R., which passes through some of the finest wheat-growing land in the Northwest; this, together with the large concession of land which would doubtless be granted by the Government, and the close connection with the Grand Trunk Railway obtained by the lease of the Wisconsin Central R. R., by which the company obtains a through line between the Atlantic and Pacific coasts, are the inducements on which the proposed extension are based. The road would receive great opposition, however, from the Canadian Pacific, whose territory it would penetrate, and it is probable that the company will be content, for some time, with completing that portion of the Great Northwest Central on which the grading has already been done.

THE TYRONE CANTILEVER BRIDGE, on the Louisville Southern Railroad, crosses the Kentucky river, near Tyrone, and is now being erected. The central span is 551 ft. between pier centers, and the two shore arms are 267½ ft. long each. The trestle approaches are 420 and 240 ft. long respectively. The entire structure is built of steel. The two towers are each 137 ft. high and rest on eight wrought-iron cylinders sunk to bed-rock. Each cylinder is 12 ft. in diameter and is lined with a 13-in. brick ring laid in Portland cement and the interior filled with concrete. These cylinders extend 4 ft. above high water and are capped with 24 ins. of hard limestone. From the bed of the river to the rail the height is 268 ft. Work was commenced in April last, and the cylinder foundations, masonry, west approach and west pier are now finished and the whole bridge is to be completed by August 15. Col. JOHN MACLEOD, M. Am. Soc. C. E., is the chief engineer and M. W. VENABLE, C. E., is engineer in charge. The Union Bridge Co. has the contract for the superstructure and H. S. Hopkins & Co. put in the foundations. This span exceeds by one foot the longest heretofore existing American span other than wire suspension.

THE LARGEST ARTIFICIAL LAKE in the world, it is said, is in Auglaize and Mercer counties, O. This body of water supplies the St. Mary's feeder of the Miami Extension Canal, and is about 9 miles long by 3 broad. It was formed by building two earth embankments from 10 to 25 ft. high, one 2 and the other nearly 4 miles long. About a half of the area flooded was a prairie and the remainder a forest. The reservoir was begun in 1837 and finished in 1845. We are indebted to SAMUEL CRAIG, of Wapakoneta, O., for this information.

THE SHIP-YARD to be built by Mr. C. P. HUNTINGTON at Newport News, Va., promises to be the largest of its kind in this country. The first part of the establishment, a dry-dock 600 ft. long, was completed several months ago, and the other work is being pushed. This ship-yard will be primarily an adjunct to Mr. HUNTINGTON'S steamship and railway interests. In addition to the transcontinental railway, he is the principal owner in the Morgan line of steamers and the United States and Brazilian Steamship Co. It is expected that the yard will be in operation next year, and the first work to be done will be the building of two steel freight steamers of 3,500 tons each. HENRY KONITZY, for 15 years with Cramp & Sons, will be in charge of the yard.

THE HUDSON RIVER TUNNEL now extends out about 1840 ft. from the Jersey side of the river and 300 ft. from the New York side. Fifty men are at work under Superintendent HASKIN and his son. It is reported that more men and some engineers will be speedily set to work. The river portion of the tunnel will be about 5,500 ft. long when completed; so that 3,360 ft. yet remain to be excavated under the river-bed, in addition to about 7,400 ft. of land approach tunnel.

A DAM in the Royal Gorge of the Arkansas river, according to the Denver *Times*, is being discussed by Mr. E. S. NETTLETON in connection with storing water for irrigation purposes. The Grand Cañon is nine miles long, with walls from 1,500 to 3,000 ft. high; and the engineers claim that between these narrow, rocky walls a dam could be constructed of almost any height, that would only wedge in the harder under any unusual flood stresses. Such a dam would mean the abandonment of the Denver & Rio Grande track, now occupying the line of this gorge, and the building of a new line. Objections to this dam have already appeared on the score of menace to the valley below. The *Times* says that engineers are now examining the ground for reservoir purposes.

THE JOHNSON PNEUMATIC TUBE CO. have set up at Marion, N. J., a working model of their system of transporting freight by pneumatic force. This is a tube 1,000 ft. long and 30 ins. in diameter, made of No. 18 sheet steel, lap-seamed and riveted, and built in sections 25 ft. long; cast-iron rings strengthen and preserve the shape of the tube. A horizontal steel bed-plate ⅜ in. thick and 4 ins. wide, riveted to the bottom of the tube, forms a track for three spherical iron carriers weighing 750 lbs. each. A small engine creates a vacuum of 30 lbs. per sq. in. in the tube, and these three carriers travel the 1,000 ft. in about 13 seconds. They can be sent singly or together at will. In practice the carriers will be made of papier maché or vulcanized wood, and will hold 250 lbs. each of freight. There are turn-outs, air-cushions, etc., too intricate for a verbal description. It is said that 12 miles of 8-ft. tubes are to be set up in Colorado as a practical working experiment. The inventor promises a speed of 150 miles per hour in carrying mails and valuable freight.

THE MOST SERIOUS RAILWAY ACCIDENT of the week occurred July 2, near Thaxton, Va., on the Norfolk & Western Railway. Heavy rains had caused a washout 70 or 80 ft. long, and 40 or 50 ft. wide; the water being 8 to 10 ft. deep; the line was supposed to be safe as several trains had passed during the night, but a passenger train ran into the gap. The engine, tender, and 7 cars went down, only the rear sleeper remaining on the track; the boiler of the engine exploded and the wreck caught fire and was burnt. The number of persons killed is estimated between 20 and 30, several being burnt in the wreck, and about 30 were more or less seriously injured. It is impossible now to place any blame, but as the dispatches state that rain had been falling almost continuously, and at times very heavily, for 24 hours, swelling the mountain streams greatly beyond their normal state, it would seem as though special precautions should have been taken by sending out trackmen to patrol dangerous parts on the line.——Another very serious accident was the derailing of the Boston & Albany express to New York, on June 29, at New Haven, Conn. New rails were being laid, and the section men had just put down a rail, but had not time to spike it when the train came along, no flag apparently having been put out. The engine passed over in safety, but all the cars except the last one were derailed and overturned. Three persons were killed and several injured. This is another accident due to the too prevalent custom of taking chances, and trusting to luck to get the track fixed before a train is due. In all cases where such work is in progress, a flag should be put out so as to warn any regular or special train; the track work will then probably be more efficiently done than when the men are working against time to prevent a possible accident. It is not so very long ago that an accident due to a similar cause, on the New York elevated railway, nearly resulted in a disaster.

BRIDGE AND TRESTLE ACCIDENTS are reported as follows: On June 27, a train of the Union Stock Yards Co. struck the guy ropes of the iron viaduct being erected over the tracks at O St., and the structure was thrown down; 8 men working on the viaduct were seriously injured.——On June 28, a trestle 1¼ miles west of Batavia, O., on the Cincinnati, Georgetown & Portsmouth Railway, gave way under a passenger train. The trestle was 100 ft. long, and 12 to 25 ft. high; the engine and baggage car got across in safety, but the directors' car and 2 passenger cars went down; 14 people were injured, some fatally. The supports are said to have been undermined by floods.

AMONG THE OTHER RAILWAY ACCIDENTS of the week were two caused by misplaced switches, one on the Boston & Albany at Dover, N. H., June 27, and one on the Chicago & Grand Trunk at Emmett, Mich., June 29.——A washed-out culvert on the International & Great Northern, near Milano, Tex., caused the wreck of a freight train, June 26. One man was killed.

HEAVY STORMS IN OHIO caused a landslide, which blocked the railway tracks at Akron, and a washout on the New York, Pensylvania & Ohio near Tallmadge.

THE CUBA DAM, in Western New York, has been investigated by the Buffalo *Express* and pronounced a parallel case, in existing conditions and threatened danger, to the South Fork dam. In addition to the data given elsewhere in this journal concerning this dam, the *Express* says that the dam broke in 1868 with only 5 ft. of water in it, and that was sufficient to cause damage to crops and bridges to the extent of thousands of dollars. The present depth of water is said to be 65 ft. It might be mentioned here that the dimensions of this dam and the area of the lake differ with each "exact" account thereof in the daily press, and we shall look with some interest for the official examination by the State Engineer which we understand is in progress.

THE LITTLE RIVER DITCH, in Northern Indiana, was completed last week, and it will eventually drain 18,000 acres of land and benefit 50,000 acres more. The contract was let in July, 1886, for $137,000, to the Little River Ditching Co., and included the digging of 40 miles of ditches and canals, over one mile of which was through a limestone ridge. The work lies in Allen and Huntington counties, between Fort Wayne and Huntington.

THE SUBURBAN ELEVATED, in New York, is reported to have let a contract for an extension of its line from 170th St., its present terminus, to Fordham. The extension is to be completed in four months, and at Fordham the Suburban is to be met by another elevated road from Mount Vernon, yet to be built.

METAL WHEELWAYS on our much traveled streets are recommended in a letter to Mayor GRANT from Gen. ROY STONE. It is an old idea revived, and the Mayor seems to be suspicious of a patent for someone somewhere hidden.

THE SOUTH FORKS DAM DISASTER was brought up last week in the evidence before a coroner's jury in Johnstown. The leading questions related to the security of the dam, and whether hay had been used to stop the leaks. Mr. JOHN FULTON, General Manager of the Cambria Works, testified that hay had been used in the rebuilding of the dam in 1880. Col. T. P. ROBERTS, C. E., stated that hay was one of the best materials that could be used to stop leaks. The general verdict was that the dam was good enough, and that an unprecedented flood and an inadequate spillway should alone be charged with the mischief. Among the facts brought out in the evidence of JOHN G. PARKE, Jr. C. E., were the following: On the morning of the break the water rose in the lake at the rate of 8 or 10 ins. per hour; at 11.30 A. M. 6 or 8 ins. of water were running over the center of the dam for a width of 75 ft. He then rode to South Forks and at 12 o'clock warned Johnstown by telegraph. The wearing process continued until nearly 3 P. M., when it had cut a hole, 10 ft. wide and about 3 ft. deep at the inner face of the dam. The dam broke between 2.45 and 3 P. M.

SOME cars of a novel type have been put in service on the Northern road of France. Each one is composed of three connected sections, each supported on four wheels, as if there were three independent cars: but internally the three sections are in communication, and form a single car with 102 seats, besides a compartment for the mail and another for the conductor, which can be used for a baggage-car when necessary. When the mail and baggage compartments are not needed for these special purposes, the car contains 132 seats. These 102 or 132 seats are divided into 12 first-class seats, 20 second-class and 70 or 100 third-class seats. The car weighs 55,450 lbs., or 543 lbs. for each seat: it is 82 ft. in length, and is provided with a central passage, which is entered from three platforms having steps at the side; the platforms at the extremities have railings, and a central gate for the exclusive use of the conductor when he desires to go from the car to the locomotive.

THE FAMOUS "ZIG-ZAG" on the New York, Ontario & Western railroad is situated partly in the neighboring town of Franklin. It has been decided to tunnel the hill, and the contract has been let to Ward, Leary & Co. The tunnel proper will be 1,600 ft. in length and the approaches 2,000 ft. Part of the dirt excavated will be used to fill in trestles. The work will commence at once.

THE PROVIDENCE, R. I., SEWERAGE is ordered to be carried out on the plans of City Engineer SAML. M. GRAY. The estimated cost of work to be done at this time is about $2,500,000. The original plan of Mr. GRAY was approved July 22, 1887. It is expected that contracts will be let shortly.

ELECTRIC LIGHT is wanted in the city of San Juan de Baptista de Tobasco, Mexico. President Diaz has authorized the State of Tobasco to erect a pier and an electric street lighting plant, and has agreed in the name of the Federal Government to guarantee the fulfilment of contracts made with builders or capitalists in the United States. WILLIAM P. BURR, 320 Broadway, New York City, has been selected to place the contracts. The estimated cost of the pier is $35,000, material admitted duty free, and a 50 years' grant of tolls on the pier. For electric light they will pay $9,000 per year for 60 public lamps. The company can supply the private demand at its own price for 10 years. San Juan is a city of nearly 6,000 inhabitants.

PLANS FOR A NEW UNION STATION and terminals at Providence, R. I., have been agreed on by the railway companies terminating at that point, and have been submitted to the City Council. The adopted plan is the one proposed by J. W. MILLER, General Manager of the Boston & Providence. It locates the station near its present site and avoids grade crossings at Acorn St. and New Francis St. Providence is one of the foremost of Eastern cities in the number of trains arriving and departing daily. At the Grand Central station, New York, there are 116 trains a day. At the Pennsylvania station, Jersey City, there are 98 trains. At Providence there are 106 trains.

NEW CROTON AQUEDUCT CONTRACTORS, Messrs. O'Brien & Clark, Brown, Howard & Co., and Rogers, Shanly & Co., are about to bring suit against the city of New York for extra work on the aqueduct, involving very large sums, says a city exchange.

BROOKLYN'S WATER SUPPLY is to be extended from Rockville Centre to Massapequa Pond, on the plans prepared by Chief Engineer VAN BUREN nearly four years ago. The sum of $4,500,000 is appropriated for the work. Proposals are to be advertised for in a few weeks. The building of the conduit and pumping stations will probably require three years' time.

THE APPLICATION OF THE CANADIAN PACIFIC RAILWAY CO. to the Treasury Department, to be bonded as a common carrier for transporting goods across American territory, has not yet been granted by the Secretary of the Treasury, and it is said that the decision will be delayed until the reports of the Senate Committees on relations with Canada and on the competition of Canadian railways with American lines have been presented. It is reported that the application has been withdrawn, but this seems unlikely. It is also stated that a temporary arrangement has been made by which through freight shipments began on July 1.

THE statistician of the *Denver Republican*, who recently reviewed the annual report of the Denver & Rio Grande, has got loose again, and a correspondent sends us one of his items as follows.

The number of locomotives in the United States is now over 29,000, to which Canada and Mexico can add about 3,300, making the total number on the North American continent not far from 32,300. The average number of locomotives per mile of road in the United States is about 5.4.

Dividing now 29,000 by 5.4, we have the total extent of United States railways as 5,400 miles!

The Properties and Use of Certain High Explosives.

A special committee of the Fire Department of the City of New York has issued, under date of May 22, 1889, a set of "Regulations" relating to the manufacture, transportation, sale and storage, and use of explosives within the corporate limits of the city. This Special Committee was made up of Gen. FITZ JOHN PORTER, Ex-Commissioner Mr. S. HOWLAND ROBBINS, Commissioner Col. CARL JUSSEN, Secretary, and J. H. STRIEDINGER, M. Am. Soc. C. E., Expert. The regulations are carefully drawn up, as might be expected from the experience of the committee expert and the members of committee, and appear to thoroughly meet all the requirements of the law, and in the plainness of their terms leave no room for doubt as to their meaning.

The publication of these regulations in full would require more space than we can spare, but the following extracts are made as being of value wherever explosives are used:

DIRECTIONS FOR THE USE OF EXPLOSIVES IN BLASTING OPERATIONS.

XXXIII. The cartridges delivered to the men shall be protected by them against frost, moisture, fire, and contact with iron, steel, or grit.

XXXIV. *It is forbidden* to use cartridges frozen or only partly thawed out.

XXXV. *It is forbidden* to warm frozen cartridges by direct exposure to fire, by keeping them before fireplaces, by putting them in stoves or on ovens, or by laying them on hot ashes.

1. *It is required* that frozen cartridges shall be returned to the foreman in charge, and shall not be reissued for use until they are thoroughly thawed out.

2. *It is required*, in thawing out high explosives, that one of the two following methods shall be observed, the first being the safest and most practicable for large quantities and therefore preferable:

Put the boxes containing the explosives in *fresh* horse manure, or entirely surround the magazine therewith.

Put the cartridges in a double vessel consisting of two water-tight tin kettles or pots, so made that one shall fit inside of the other and leave a space for water (which must be lukewarm) between the bottoms and sides.

XXXVI. *It is forbidden* to attempt to break or cut cartridges entirely or partly frozen.

XXXVII. *It is forbidden* to prime more cartridges with fuses and detonators than are actually needed at the moment, or to keep on hand such primed cartridges.

XXXVIII. *It is forbidden* to use metallic rammers in tamping drill-hole charges.

XXXIX. *It is forbidden* to "bring home" the tamping by powerful strokes.

XL. *It is forbidden* to introduce into a drill-hole more than one primer, or to roughly handle the primer, especially while placing it on top of the charge, or while tamping it.

XLI. *It is forbidden* to approach a drill-hole charge which failed to explode without waiting at least ten minutes, counted from the time of setting fire to its fuse.

XLII. *It is forbidden* to remove the tamping of a charged drill-hole.

XLIII. *It is required*, in case an attempt to fire a "missed blast" by means of exploding a strong primer on top of it is unsuccessful, that a new hole be drilled not nearer than twelve (12) inches from the first one, and a fresh charge put in (that being the safest method), the explosion of which will probably be communicated to the first charge, or if it is not, will at least dislodge it. But the distance between these holes must be increased if there is any reason to believe that the nitro-glycerine mixture of the first charge has spread laterally.

XLIV. *It is forbidden*, in case the explosion of a charge does not carry away the whole drill-hole, leaving the lower part intact, to use the remaining part of the old drill-hole as a starting point for a new drill-hole; because portions of the former charge may remain and explode when exposed to the blows of percussion drills.

XLV. *It is forbidden* to allow boys under twenty-one years of age, or men who cannot read English, or are uninstructed in the care of high explosives, to be in the vicinity of hand magazines or to handle such explosives.

XLVI. *It is required* that, to insure the safety of surrounding property and of persons in the vicinity, no larger charge shall ever be used than is necessary to properly start the rock.

XLVII. *It is required* that rock excavations contiguous to any structure, shall be so carried on as not to cause any damage to such structures. To secure this, weak walls, etc., of such structures must be shored up; and all rotten or decomposed rock must be removed by the use of gads, picks and crow-bars only. When blasting next to such structures is unavoidable, light face blasts only, with short lines of resistance and small charges, shall be used.

XLVIII. *It is required* that only careful, reliable, and thoroughly experienced foremen shall be employed in blasting operations.

XLIX. *It is required* that in the neighborhood of roads, houses and objects which may be damaged by blasts, the shots shall be carefully covered (preferably with brush mattresses, fascines, and the like), and the charges shall be so reduced in size that no flying about of débris shall be possible. Red flags shall be placed at reasonable distance from the blast on all sides; a whistle shall also be blown or a bell rung five minutes before the explosion takes place, to give all persons proper warning. Men shall also be stationed at the doors of houses in the immediate vicinity and on the different highways and sidewalks to caution all persons against approaching the blast.

NOTES ON THE PROPERTIES OF CERTAIN HIGH EXPLOSIVES.

I. Pure nitro-glycerine, at 60° Fahr., has a specific gravity of 1.6. It is odorless, nearly colorless, and has a sweetish, burning taste. It is poisonous. Handling it is apt to cause headache. It is slightly soluble in water. It will explode when heated to a temperature of about 356° Fahr.

II. These properties undergo no change when nitro-glycerine is absorbed by other substances, in forming nitro-glycerine mixtures or dynamites such as those enumerated in the paragraph defining the term "high explosives."

III. The temperature at which nitro-glycerine mixtures freeze varies from 39° to 53° Fahr., according to the difference in the methods of manufacture and the quality of the nitro-glycerine used. The use of such substances as silicious marl ("Kieselguhr") as an absorbent in the manufacture of dynamite or giant power No. 1, undoubtedly hastens their freezing.

IV. Reliable experiments made in Austria show that frozen nitro-glycerine mixtures are less liable to explode from mechanical shocks than when they are not frozen.

V. When, however, the nitro-glycerine mixture is in a partly frozen condition, or when it is either in process of freezing or thawing, its sensitiveness to explosion is greater than when in its normal condition; and it is then especially liable to be exploded by repeated light shocks, such as are produced in the operation of packing, transportation, etc. The experience, both of the laboratory and of the factory, confirms these views.

VI. As before stated, nitro-glycerine mixtures explode at a temperature of about 356° Fahr. They also explode by percussion, concussion, friction, pressure, etc., viz: by any act converting mechanical energy into heat.

VII. By the use of fulminate of mercury caps as an initiatory explosive the entire mass of a nitro-glycerine mixture is converted into gas with such suddenness that it may practically be considered instantaneous; this sudden effect is termed "detonation."

VIII. In dynamites containing a large percentage of nitro-glycerine, the latter is liable to exude or ooze out. This is especially so in warm weather, or in thawing out at high temperatures.

IX. Exposure to water is injurious to dynamites. In the high grades the water, by its greater affinity for the inexplosive absorbent (Kieselguhr), drives out the nitro-glycerine; in the lower grades, it is apt to dissolve the salts (nitrates of potash or soda, etc.), contained in the explosive absorbent, thus setting free the nitro-glycerine.

X. Nitro-glycerine mixtures are usually put up and sold in cylindrical paper shells or cases, in "cartridge" form. These cartridges are furnished to order of any required diameter and length, and are packed in boxes containing each 25 or 50 lbs.

American Railroad Bridges.

One of the most interesting papers presented to the American Society of Engineers at the Seabright Convention is that of Mr. THEODORE COOPER on "American Railway Bridges." It is interesting from the historical matter contained in it, and here first systematically gathered together, and valuable as showing the progress of a branch of engineering that has made our country famous for its works of this nature. The paper is necessarily long, so that we cannot publish it in full, even did the rules of the society permit, and we must content ourselves with the following abstract. We congratulate Mr. COOPER upon the success attending his efforts to unearth and arrange much matter relating to the early history of wooden bridge building that has usually been considered inaccessible.

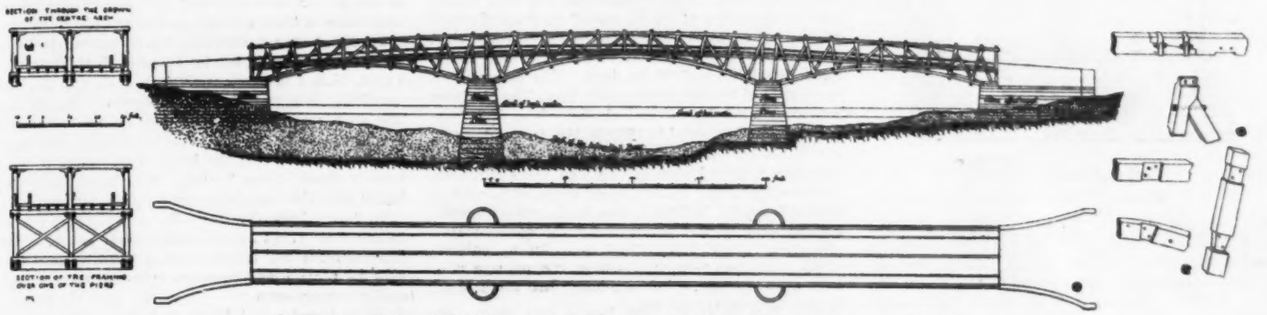
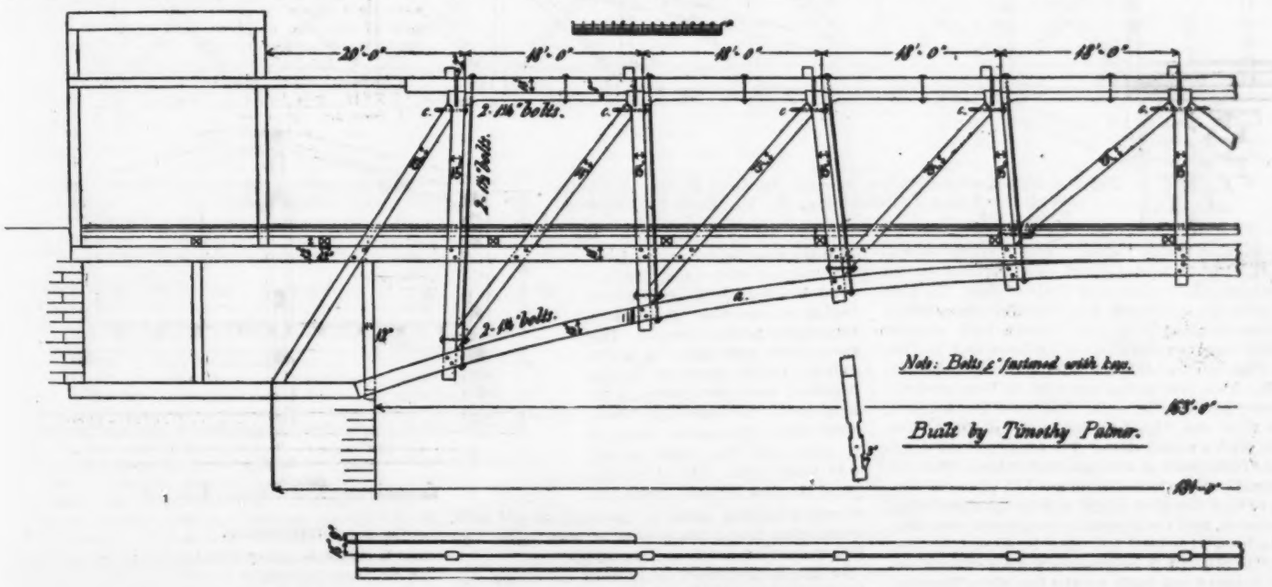


Fig. 1.—Schuylkill Permanent Bridge. Built by TIMOTHY PALMER, 1804-06.

While the paper is devoted to the railroad bridge, the writer very properly first briefly sketches the past history of bridges in America, as well as the imperfect data will permit. The "Great Bridge," built in 1660 to connect Cambridge and Brighton, near Boston, was a pile bridge and the first of record. For about 100 years we hear of no other, until, in 1761, SAMUEL SEWELL built a bridge over York river in Maine, 270 ft. long, supported on 13 piers. In 1786 this same SEWELL built a bridge 1,503 ft. long on 75 piers over the Charles river at Boston. Records show that a year or so later there were similar bridges at Malden and Beverly, Mass. In 1792 Col. WM. P. RIDDLE erected the Amoskeag bridge at Manchester, N. H. This structure was 556 ft. long, and was supported on five piers and two abutments. It was commenced on August 3, "at which time the timber was growing and the rocks dispersed in the river," and was finished on September 29. Between 1785-92 Col. HALE crossed the Connecticut river at Bellows Falls with a bridge 368 ft. long in two spans. The West Boston



Plan of chord a.

Fig. 2.—Highway Bridge across Delaware River at Easton, Pa. Built by TIMOTHY PALMER, 1805.

ASSINIBOINE (Manitoba) WATER POWER has been reported upon by J. T. FANNING, C. E., who was engaged for this purpose by the City Council of Winnipeg. The Assiniboine has a water-shed of 58,352 sq. miles, with a mean annual rainfall of 18 ins. The extreme flood flow is about 1 cu. ft. per second per square mile, or about 60,000 cu. ft. per second for the total area; the ordinary flow is about .044 cu. ft. per second per square mile. Estimates for a dam and canal, securing 10,000 H. P., amount to $400,000. The dam would be near Winnipeg, and the river could be reinforced from Lake Manitoba.

bridge, 3,383 ft. long on 180 pile bents, was finished in 1793.

About 1800 a pile bridge, in 25 ft. bents and nearly one mile long, was built over Cayuga Lake, N. Y. In 1795 the Mohawk river was crossed by a bridge

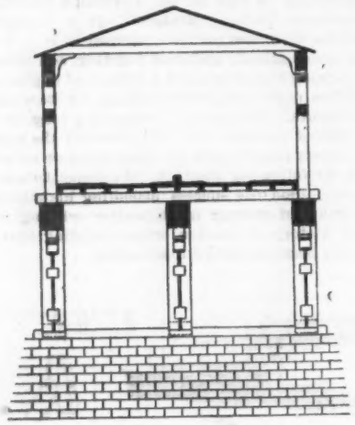


Fig. 3.—Easton Bridge.

960 ft. long on 13 piers. In 1792 TIMOTHY PALMER built the Essex-Merrimac bridge over the Merrimac 3 miles above Newburyport, Mass. There were two bridges starting from Deer Island in the river. An arch of 160 ft. span and 40 ft. above high water made up one bridge; but of the other it is only known that it was "wider," with a center arch of 140 ft. But it is also stated that the arch on the Newbury side "is hung on chains" from the high steep banks, and that it was "the first chain bridge in New England." In 1793 PALMER built another bridge over the same river at Andover, and, in 1794, the Piscatauqua bridge, 7 miles above Portsmouth, N. H. This last bridge was 2,362 ft. long, with the greater part of pile work. But over the center of this river was "a stupendous arc" of 224 ft. 6-ins. span, with a versed sine of 27 ft. 4 ins., and the depth of the framework of arch was 18 ft. 3 ins. The arch segments were selected from crooked pieces of timber, so that the fibre might run in the direction of the curves, and the general arrangement was such as to justify the local historian in remarking that this "is allowed to be a masterly piece of architecture, planned and built by the ingenious TIMOTHY PALMER, of Newburyport, Mass." In 1796 PALMER built a bridge over the Potomac, at Georgetown.

In 1796, RUFUS GRAVES built a bridge over the Connecticut river, at Hanover, N. H., consisting of a single arch of 236 ft., patterned after the Piscatauqua bridge of PALMER. This bridge fell in 1804 by its own weight. In 1795, a bridge 1,000 ft. long, made up of four arches and one draw-span, was erected between Newbury and Haverhill. It was carried away by ice in 1818. In 1794, PALMER built the bridge at Haverhill, with three arches of 180-ft. span, supported on handsome piers 40 ft. square. Bridges at Windsor, N. H., Rowley, Mass., and two over the Lehigh, at Bethlehem and Easton, complete the record as far as found for the eighteenth century.

In 1804-06 the Permanent Bridge over the Schuylkill at Philadelphia was designed and built by TIMOTHY PALMER. This bridge is shown in Fig. 1, and lasted until 1850, when it was renewed by a more modern wooden arch and widened to carry a railroad track. In 1805 Mr. PALMER built the bridge at Easton, Pa., on a very similar design, shown in detail in Fig. 2. This Easton bridge had three spans of 163 ft. in the clear, and is still in use after 84 years' service, with about five-sixths of the timber yet in good condition.

In 1804 THEODORE BURR built the Waterford bridge over the Hudson, consisting of four arch spans of 154 ft., 161 ft., 176 ft., and 180 ft. This bridge was built of hewn yellow pine and was not covered until 1814. It is still in use and in reasonably good condition (see Fig. 4). BURR also built another bridge over the Hudson, at Fort Miller, and in 1804-06 built the Trenton bridge (Fig. 5) over the Delaware river. This bridge had five arch spans, two of 203 ft., one of 198 ft., one of 186 ft., and one of 161 ft. in the clear. Each span had five arched ribs, made of white pine plank, 4 ins. thick, and breaking joints in an arch 32 ins deep. The lower chord was made of two sticks 6⅛ x 13⅜ ins. The roadway was suspended by vertical chains. The arch footings required renewal in 1832; in 1848 the bridge was remodeled by removing the wing arches shown, and adding a new and stronger arch on the south side, and strengthening the old arch rib so as to carry a railroad track; in 1869 it was again strengthened; and in 1875 it was replaced by the present iron structure.

The Schenectady bridge over the Mohawk (Fig. 7) was built by BURR in 1808, replacing a previous bridge also built by him, which had fallen before or just after construction. The tradition is that the first bridgewas to have two spans of 450 ft. each. The second bridge is a curiosity in bridge construction, for it is a suspension bridge in wood. The curved ribs were made of eight 4x14-in. plank spiked or bolted together, with the planks cut to long bevels for splicing. There were three ribs spaced about 13 ft. apart, and the timber used was white pine. This bridge stood thus for 20 years, until the excessive sagging made it necessary to put additional piers under the middle of each span. In 1873 it was replaced by an iron bridge.

In 1812-16 THEODORE BURR built the bridge over the Susquehanna at Harrisburgh, Pa., with twelve spans of 210 ft. One-half of this bridge still remains, connecting an island with the mainland.

LEWIS WERNWAG built his "Colossus"* bridge over the Schuylkill river at Philadelpha in 1812. This bridge, with its clear span of 340 ft. 3¾ ins., was destroyed by fire on Sept. 1, 1838. In 1814 WERNWAG built the Newhope bridge over the Delaware river, with six arched spans of 175 ft. each. In 1810 he built a wooden cantilever bridge over the Nashamony river, Pa., and called it his "Economy" bridge and claimed that it could be used to advantage up to 150-ft. spans. WERNWAG built many bridges from this date to 1836, including his first railroad bridge in 1830 at Manogway on the Baltimore & Ohio R. R., and his last bridge carried the railroad over the canal and Potomac at Harper's Ferry, Va.

All of the previously mentioned bridges of any magnitude seem to have been arch bridges, and the first marked step towards bridges of modern-truss form was the wooden lattice, patented by ITHIEL TOWN in January, 1820. This bridge (Fig. 8) had its horizontal members, or chords, composed of two or more parallel sticks so spaced that the diagonal web members passed between them. The timbers were usually 2 to 4 ins. thick and 10 to 12 ins. wide. The timbers were of one size and of reasonable dimensions, and all connections were made with wooden treenails, so that these features, combined with the simplicity of its erection, made it a cheap and popular structure. A great number of these bridges were built in the United States, up to spans of 220 ft. for both highway and railway purposes, and many of them are still in existence.

The next step toward simplicity of construction was the truss patented by Lieut.-Col. STEPHEN H. LONG, U. S. Engineers, in March, 1830, and November, 1839. Many of his bridges were combined with the arch, as was also the Town lattice, especially for long spans. In 1840 WILLIAM HOWE patented the truss which was the basis of the present well-known Howe truss bridge. For some years this latter was the standard truss for use on railroads.

In April, 1844, THOMAS W. and CALEB PRATT patented the truss known under their name, which differed from the Howe truss in having the diagonals in tension and made of iron and the verticals under compression were in wood, just the reverse of HOWE'S patent. The Pratt became the favored form and was afterwards adopted for iron bridges,

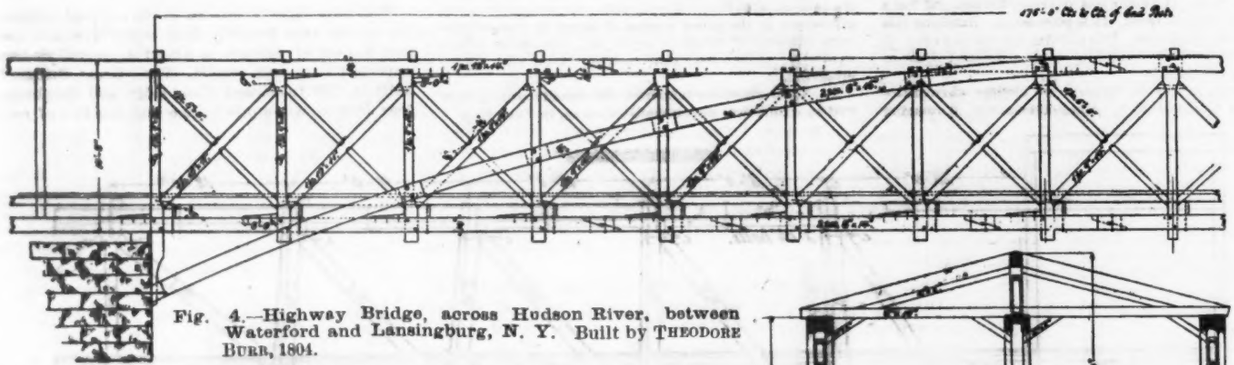
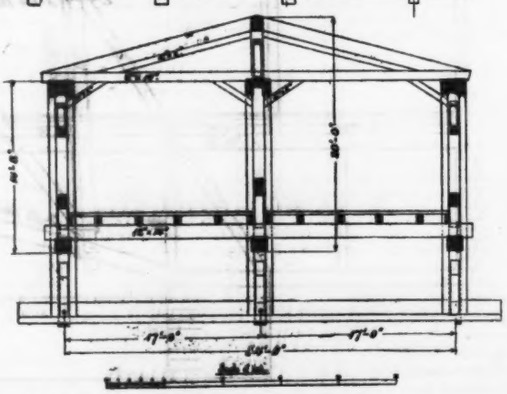


Fig. 4.—Highway Bridge, across Hudson River, between Waterford and Lansingburg, N. Y. Built by THEODORE BURR, 1804.



Cross-Section.

and is therefore one of the steps in the development of American bridges.

The history of iron bridges really reaches back to 1786, when THOMAS PAINE made three models for a bridge over the Schuylkill in Philadelphia—one in wood, one in cast-iron, and one in wrought-iron connected with blocks of wood representing cast-iron blocks. At this time the only iron bridge in England was the cast-iron arch over the Severn near Coalbrook Dale. PAINE took his last model to Paris in 1787, and proposed it for an arch bridge of 400-ft. span, and afterwards actually had built in England five cast-iron arch ribs of 110 ft. span to test his theories; but the engineer's interest in bridges was lost in his interest in the French Revolution, and his bridge was sold for the benefit of his creditors. He made a vain attempt in 1808 to enlist the U. S. Congress in his bridge building projects.

Nothing more was done with iron bridges unti

* See ENGINEERING NEWS, Aug. 13, 1885, for plans of this and two other Wernwag bridges here described.—ED. ENG. NEWS.

about 1830, when LONG and TOWN both suggested that their bridges could be built of iron. In 1833 AUGUST CANFIELD took out the first patent for an iron truss bridge, and the first one actually built is believed to be the one erected over the Erie canal, at Frankford, N. Y., in 1840, by Mr. EARL TRUMBULL. But in the same year SQUIRE WHIPPLE built his first iron bridge, and he took out a patent on April 24, 1841. In 1846-47, JAMES MILLHOLLAND built a boiler-plate tubular girder 55 ft. long for the Baltimore & Ohio R. R. In 1846, FREDERICK HORBACH patented an iron Howe truss, and a bridge of this type was built in 1846-47 on the North Adams branch of the Boston & Albany R. R., near Pittsfield, Mass. In 1847-50, NATHANIEL RIDER built for the New York & Harlem, Erie, and other railways, a number of iron bridges with parallel top and bottom chords and multiple systems of vertical posts and diagonal ties. The top chords and posts were cast-iron and the lower chord and ties were flat bars of wrought-iron. The failure of one of these Rider bridges in 1850, on the Erie R. R., following the failure of the English bridge over the river Dee, caused the officials of the line to declare iron bridges untrustworthy and they directed all iron bridges, consisting of several Rider and some Whipple bridges, to be taken down. They were replaced by wooden structures.

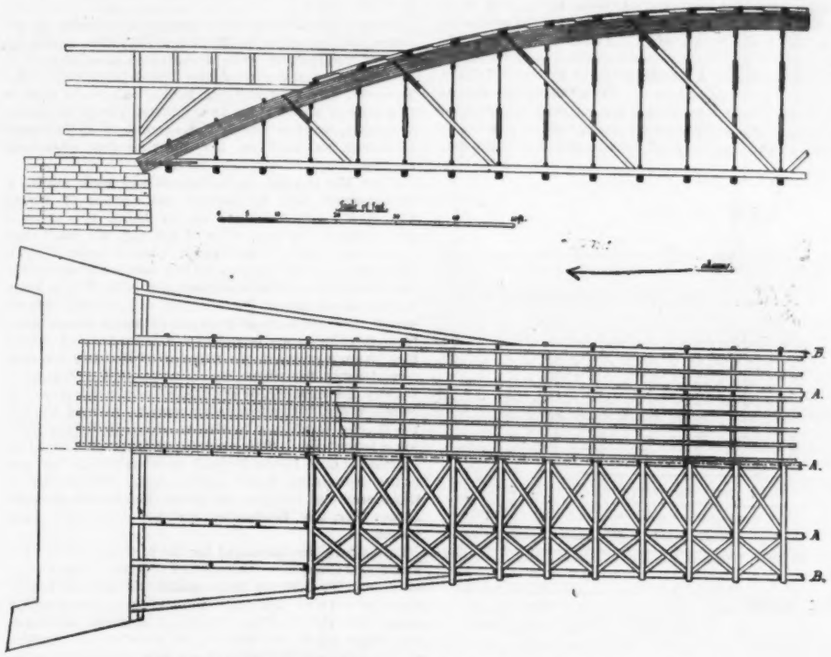


Fig. 5.—Trenton Bridge. Built by THEODORE BURR, 1804-06.

It is claimed that the general adoption of iron for railroad bridges was given its first impulse by Mr. BENJAMIN H. LATROBE when, as Chief Engineer of the Baltimore & Ohio R. R., he extended the road from Cumberland to Wheeling and decided to use this material in all the bridges. His assistant was then Mr. ALBERT FINK, whose plans were adopted for all these structures

From henceforward it will be sufficient simply to give the names and dates of some of the more prominent early iron bridge designers. In 1852 a Boilman truss of 124 ft. was built at Harper's Ferry, and in 1851-52 three 205 ft. Fink trusses were built over the Monongahela river. In 1852-53 SQUIRE WHIPPLE built an iron bridge of 146 ft. span on the Rensselaer & Saratoga R. R., 7 miles north of Troy, N. Y., on the type afterwards known as the Whipple truss. It continued to do good service until 1883, when it was taken down, owing mainly to the great increase in the rolling loads coming upon it.

Mr. F. C. LOWTHORP built his first railroad bridge in 1857 on the Catasauqua & Fogelsville R. R. In 1856 JOHN W. MURPHY, C. E., built a Whipple bridge, still standing, over the Saucon Creek for the North Penna. R. R., and in 1858-59 Mr. MURPHY built a Whipple-Murphy truss over the canal at Phillipsburg, N. J., with 165 ft. span. In this bridge he substituted pins of unturned wrought-iron and looped eyes on his tension members, for the cast trunnions on the foot of the Whipple post and the wrought-iron links there used. This, Mr. COOPER says, is the first truss bridge that he has been able to discover that was pin-connected throughout.

In 1861 Mr. JOHN H. LINVILLE built a bridge on the Delaware extension of the Penna. R. R. over the Schuylkill river, in which were used for the first time wide forged eye-bars and posts formed of wrought-iron sections. The bridge built by JOHN W. MURPHY over the Lehigh in Mauch Chunk, in 1863, was the first in which he used wrought-iron for both posts and top-chord sections, and it was probably the first American truss in which the tension and compression members were both of wrought iron. He used cast-iron joint blocks and pedestals, however.

The Post truss was first used in 1865 by Mr. S. S. POST on the Erie railway. In 1859 Mr. HOWARD CARROLL commenced building riveted lattice bridges for the New York Central R. R. and its connections, and was followed therein by Mr. CHARLES HILTON, his pupil. In 1864, Mr. FELICIAN SLATAPER designed and built a bridge of five riveted lattice spans of 178 ft. each over the Allegheny river at Pittsburg.

Mr. LINVILLE inaugurated the era of long-span bridges in America with a channel span of 320 ft. in the Steubenville bridge over the Ohio river, built between 1863-64. Mr. FINK followed in 1868-70 with the Louisville bridge, with two main spans of 360 and 390 ft. In 1870 Mr. LINVILLE put 340 ft. spans in the Parkersburg and the Bellaire bridges over the same river, and in 1872 he built the Newport and Cincinnati bridge with a channel span of 420 ft. In 1868-74 Mr. JAMES B. EADS built the St. Louis bridge with its two arches of 503 ft. and center arch of 520 ft. clear span. In 1876 the Cincinnati Southern bridge was built with a 519 ft. truss (the largest truss span to that time) from specifications of Mr. G. BOUSCAREN and designs by Mr. J. H. LINVILLE. The channel spans of the Henderson Bridge, 522 ft., and of the Ohio River, Kentucky Central R. R. bridge, at Cincinnati, 550 ft., are the only independent truss bridges up to this time, with greater spans.

There are now in existence on American railroads over five miles of bridges with spans from 300 to 400 ft., nearly four miles with spans from 400 to 500 ft., and two and one-half miles with spans exceeding 500 ft. estimated as single-track bridges and excluding wire suspension bridges.

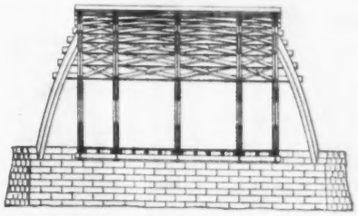


Fig. 6.—Trenton Bridge; Cross Section.

The first cantilever bridge of importance was built in 1876-77 by C. SHALER SMITH over the Kentucky river. The second and third were the Niagara and the Frazer river bridges, designed by Mr. C. C. SCHNEIDER, the first in 1883 and the other in 1885. The largest cantilever is the Poughkeepsie bridge, lately completed.

The remainder of Mr. COOPER'S paper is devoted to designing and proportioning bridges, the strength of material and parts of skeleton structures, the manufacture of bridges, the erection of bridges, the relative merits of typical American railroad bridges, and statistics of the amount and kind of bridges on the railroads of the United States. This matter is of a character that cannot be dealt with justly or usefully by an abstract, and we will not attempt at present to give any more than the above outline of its value.

Fig. 7.—Mohawk Bridge at Schenectady, N. Y. Built by THEODORE BURR, 1808.

Some Results with Secondary Batteries in Train Lighting.*

The arguments in favor of the incandescent electric light for railway passenger trains are so well understood by the members of the Institute, from their own general knowledge of the subject, as well as from papers previously presented, that it is unnecessary for me to allude to its admitted superiority over either gas, oil, or candles It is now four years since the Pennsylvania Railroad, appreciating the advantages of electric lighting for this purpose, began a series of experiments with the secondary battery, for the illumination of parlor cars.

I am unable to give the cost of lighting by any of the batteries referred to, as the expense appears to have been a secondary consideration compared with the necessity of securing the best system of illumination.

The first experiments made by the company were with the Faure accumulator, which was brought to this country from France in the spring or early summer of

*A paper read before the American Institute of Electrical Engineers, New York, by ALEXANDER BROWN, May 21, 1889.

1882, and put on passenger coach No. 397 in August of that year. The car was run for a few days only, but enough was learned in that time to show that the lighting of cars by secondary batteries was perfectly practicable, when a modified form of the battery could be obtained.

In the summer of 1884, experiments with the Brush storage batteries were commenced at the Altoona shops of the Pennsylvania Railroad, and continued through the fall and winter of that year. These experiments were made by Dr. DUDLEY, and proved so successful that eight parlor cars, which were being constructed at that time, were equipped for incandescent lighting and put into regular service on April 1, 1885.

The Brush cells used consisted of three plates each, two negative and one positive, the amount of surface of the positive plate being equal to that of both the negatives. The plates differed from those now used, there being no paste in their composition. The negative plate was designed to give the greatest possible amount of surface from the least weight of material. The positive plate measured 8 × 9 ins. x 1 in. and the negative 8 x 9 ins. x ¼-in.

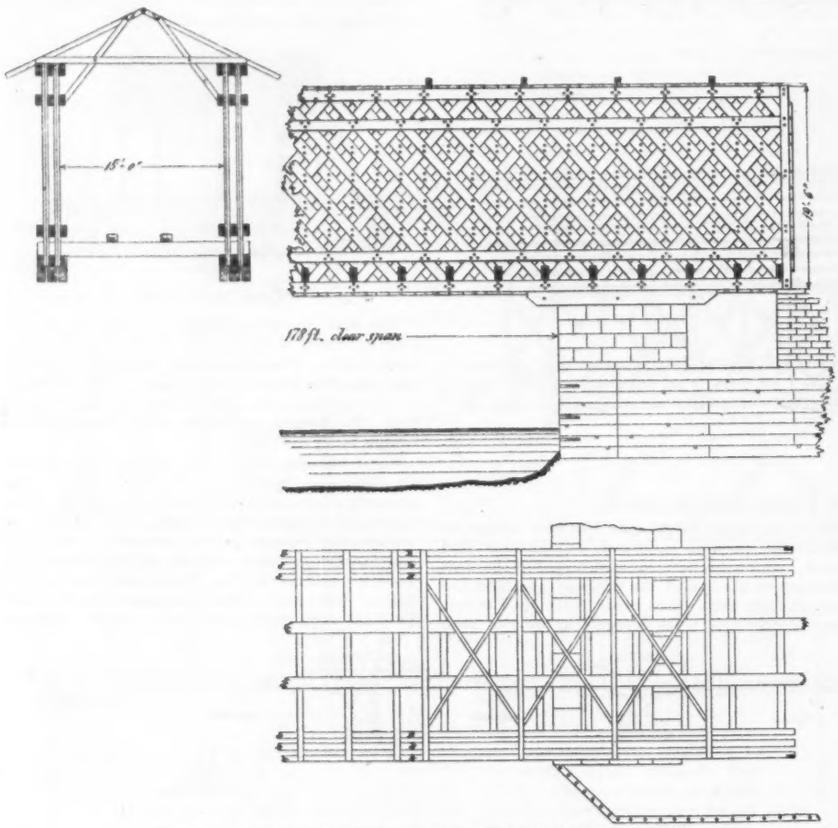


Fig. 8.—Town Lattice Truss, Patented by Ithiel Town, 1820.

These batteries were rated at 70 ampere hours, but the hard usage they received soon reduced their capacity, and at the end of a year's time the positive plates were almost entirely destroyed. In fact I have taken plates out of the cells which had holes in them fully 4 ins. in diameter, while the deposit in the bottom of the cell would be from 1 to 1½ ins. in depth. The plates also had a decided tendency both to buckle and grow, and in a number of cases it was a very difficult matter to remove the plates without injury to the cell; you will understand, of course, that I allude more particularly to the positive plate. The weak points in the Brush battery were the small number of ampere hours per pound of material—about two I believe. There was a tendency to buckle and sulphate, and the arrangement for connecting the plates was such that there was oxidation at the junction, causing the place to break when subject to the motion of the car. The last feature was a source of endless trouble to us, and, as is usually the case, was sure to happen at a time or place where it was impossible to repair a break. While using the Brush battery, the cars were wired with the battery boxes, one on each side of the car, coupled together in series, each box holding three trays, and each tray containing four cells, this giving a total of 25 cells to a car, or a current of 49 volts. The lamps used originally were of the Brush-Swan type, with small platinum loops projecting from the base, these hooking into a socket, and held in place by a spring, this socket fitting into another one, to which the connections to the wires were made.

After using this style for some time, an improved pattern of Brush-Swan lamp was substituted, but the great drawback to this lamp was its frailty, the breakage per day often averaging 4 per cent. of the total number of lamps in use on all the cars. These lamps required about 45 volts and one ampere of current, and each car contained 10 lamps, seven in the body, one in the smoking room and one in each vestibule, thus using about 10 amperes of current; and as the batteries were rated at 70 ampere hours, we should have obtained from 6½ to 7 hours good light, but it was very seldom, after the batteries had been used for a short time, that we could get over 5½ hours. As will readily be seen, this could hardly be called economical, for to obtain 5 or 6 hours' light we were obliged to charge from 15 to 20 hours with a Brush arc light dynamo giving a current of about 10 amperes. Then taking the weight into consideration, each time the car needed charging, the trays, 6 in number, and weighing 1,200 lbs., had to be loaded on the truck, pulled over to one side of the car, and there discharged trays taken out and the freshly charged ones put in their place.

The remaining three were then taken around to the other side of the car and charged in the same manner. As the cars invariably stood on a double track, it was necessary to carry half the trays for some distance, over tracks, etc. Then, again, the tracks were usually full of cars, and if there was not sufficient time for them to be parted, the batteries had either to be carried under the car or over the platform. Under the present system this has been done away with to a great extent, as will be explained subsequently. During the month of December, 1886, we commenced using one battery of the 7 B type, manufactured by the Electrical Accumulator Company. This battery was a decided improvement over those previously used, giving as it did nearly double the number of ampere hours for the same weight of material. After using this battery for about a year, the positive plates began to give way, and new ones were substituted, the negatives, however, being retained, they not having deteriorated. In fact we are still using the negative plates of our original 7 B battery. This battery proved to be so satisfactory that in June, 1887, we added two more of the same type, and two manufactured by the Julien Electric Co. The latter batteries were similar in size and shape to the 7 B type of the Accumulator Company, but did not seem to stand the hard using so well, as they would crack instead of buckling, and allow a large quantity of the paste to become loosened and fall out. It is proper to state, however, that these plates were made especially for us, to fit the cells we were using, and were not of the regular Julien type. This, no doubt, will account in a great measure for their failure to keep up to the standard of the present type of Julien batteries. After the positive plates of this battery became worthless, not having any others to put in their place, we decided to make a kind of consolidated affair and see how the Julien negative and accumulator positive plates would work together. The result was extremely satisfactory, and we have had no trouble with them whatever, excepting the occasional buckling of a positive plate.

During the fall of 1887, we began substituting the accumulator batteries for the Brush batteries, and by the end of the year we were using them altogether, with the exception of the two Julien I have mentioned. We, however, kept 96 of our best Brush cells, to be used in the case of an accident to the incandescent dynamos, which are used to supply the current of the railroad telegraph as well as for lighting the passenger station.

After the change in batteries had been made, it was thought best to change the system of wiring the cars, so that instead of its being necessary to put batteries on each side of the car, we need only put them on one side and get the same amount of light. This was done by connecting the two boxes under the car in parallel, and substituting a 23 volts Edison lamp for our 45 volt Brush Swan lamps. After doing this we found that we were able to get as many hours light from 12 cells as we formerly did from 24. Of course this change reduced the expense of lighting the cars considerably, for where we formerly had a change of battery for each car, or 48 cells, we now needed only 24 cells per car, with a few extra ones to be used in case the 12 cells would not be able to supply sufficient light for a long trip. This system of lighting proved so successful that it was decided to substitute it for gas in the remaining seven parlor cars. The wiring of these cars was commenced at the Meadow shops, near Jersey City, last September, and has just been completed.

These cars are arranged for the 23 C type of the Accumulator Company's battery and 19 B type of the Julien battery. The battery boxes under the cars are larger than the old style and contain four trays or 15 cells, the lamps we used taking 23 volts of current. Changes were also made the first of the year in the system of charging, and the batteries are now charged from an incandescent dynamo instead of an arc, thus enabling the batteries to be charged with any amount of current desired. In connection with this description of the four years' work of the Pennsylvania Railroad, I would like to add something in regard to the electric lighting of the Chicago limited express.

In 1887, the Pullman Palace Car Company commenced using the electric light on one of three trains of the New York & Chicago limited express, and the charging of the batteries at Jersey City was given into the hands of the Pennsylvania Railroad. The batteries used were the 7 B type of the Electrical Accumulator Company, 30 cells to a car, and usually there were six cars in the train. These batteries would furnish enough light for one trip, and each time the train arrived at either terminus it was necessary to replace them with freshly charged cells. This was not objectionable at Chicago, for the train arrived there in the morning, so that they could be charged during the day; but in Jersey City, where the train did not arrive until evening, the work was very difficult on account of the dynamo being in use for other purposes. After this one train had been running for a short time, another one was fitted up, 19 B type of Julien battery being used. It was thought that this would give us a chance to see which was the better of the two batteries, but they both worked very well considering the treatment they received. After Mr. BAUER became connected with the Pullman Company, he did away with charging the batteries at the ends of the line, and introduced a Brotherhood engine and Eickemeyer dynamo in the baggage car of each train, in order that the batteries might be charged in transit. When the train leaves Jersey City, the baggage car is on the rear, and consequently no charging is done until it leaves Philadelphia, where the train is reversed, bringing the baggage car next to the locomotive. The batteries are charged continuously until the train reaches Chicago, and the same practice is continued on the return trip. The steam for driving the Brotherhood engine is taken from the locomotive boiler, and the exhaust is used for heating the train.

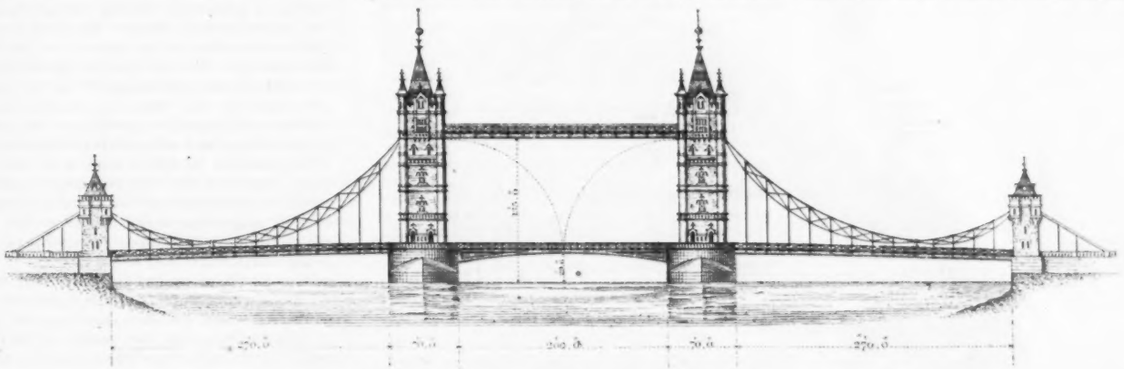
So far as the Pennsylvania Railroad is concerned, the electric lighting of passenger trains may be considered an assured success; and leading as it does to the abolition of kerosene lamps, and incidentally encouraging the adoption of steam heating, the safety and comfort of the passenger are certainly increased.

The Tower Bridge in London.

We have received from our correspondent a very handsome leaflet, issued in honor of the visit of the American engineers to the Tower bridge in London, on June 14. We reproduce the excellent illustration heading the page, and here give, as a bit of handy information, the data attached:

	Feet.	Ins.
Total length of bridge and abutments	940	
" " " " " approaches	2640	
Opening span—width	200	
" " headway above high water, when opened	135	
" " headway above high water, when shut	29	6
Side spans—width	270	
" " headway above high water	from 30	27
Width between parapets—Opening span	50	
" " " Side spans and approaches	60	

Steepest gradients of approaches, 1 in 40.
(NOTE.—Steepest gradient of approaches of London bridge, 1 in 27).



The Tower Bridge, now under Construction across the Thames, London.

	Feet.	Ins.
Depth of foundation, 60 ft. below T. H. W., 27 ft. below bed of river.		
Sectional area of waterway, 20,040 sq. ft. (NOTE.—London bridge, 19,300 sq. ft.)		
Depth of water in opening span at high water	33	6
" " " " " " " low water	13	6
Size of each leaf of opening span, 50 ft. wide by 100 ft. long.		
Weight of each leaf of opening span, including roadway and counter-balance weights, 950 tons.		

Estimated Quantities of Materials in the Bridge and Approaches:

Bricks	31,000,000
Concrete	70,500 cu. yds.
Cement	19,500 tons.
Granite and other stone	235,000 cu. ft.
Iron and steel	15,000 tons.

Machinery.

Two steam pumping engines for hydraulic machinery, each 360 H. P.
Eight large hydraulic engines and six accumulators.
Four hydraulic lifts in towers for passengers.
Estimated cost of works £750,000
Engineer: JOHN WOLF BARRY.
Resident Engineer: E. W. CRUTTWELL.

CONTRACTORS.

For foundation and northern approach: JOHN JACKSON.
For southern approach: WILLIAM WEBSTER.
For iron and steel work of superstructure: WM. ARROL.
For masonry of towers: PERRY & Co.
For machinery: Sir W. G. ARMSTRONG, MITCHELL & Co. Ld.

Recent Experience in Sewage Treatment.*

The author, as one of four commissioners selected to describe the results latterly obtained in Germany of the various systems of clarifying sewage by precipitation, points out the general conditions which must be taken into consideration in the selection of the method of treatment, and states that, in consultation with his three colleagues, a uniform arrangement of their communications has been adopted, in order to facilitate the comparison of the results in each case. The sewerage system of Frankfort is one of the most complete in Germany. It is not a conglomeration of old sewers adapted to modern requirement, or intercepted by a few main sewers, but a complete network of new sewers has been built upon the most improved lines, and is arranged on the combined system to take the whole of the waste liquids and dejections of a population of 150,000 persons, occupying an area of 10 sq. kilometres. The average daily flow varies from 25,000 to 30,000 cu. metres (5½ to 6½ million galls.) All the houses are completely drained. Cesspools and sludge-chambers with overflows into the sewers are prohibited. The population is provided with 30,000 water-closets. The sewers have occupied 20 years in execution, from 1867 to 1887, and, with the exception of those for a small district liable to be flooded, inhabited by about 5,000 persons, they may now be said to be complete. Until the tanks were ready, there was a temporary outfall into the Main which served until 1885. The original intention was to treat the sewage by irrigation, but, after several years of discussion, it was resolved in 1881 to have recourse to simple deposition in tanks, without chemical treatment: the Government, however, would give its consent to the tank treatment only on the condition of the adoption of some chemical system of precipitation.

The plans having been approved by the Government in 1882, the works were put in hand at once, and they have now been upwards of a year in operation. In the first instance, when a mechanical system of purification only was to have been adopted, the tanks were designed in duplicate for each bank of the river, and no machinery of any kind was provided. But when chemical treatment had to be undertaken, it was necessary that the outfall works, with their costly plant, should be united and concentrated at one spot. The choice of a site was an easy matter, as the requisite conditions summed up by the author were only to be found on the left bank of the stream, and it was in this direction only that it might become possible in the future to make use of the effluent for irrigation purposes. The reasons which led to the construction of covered tanks, and to the avoidance of pumping, are discussed in detail.

The tanks are arranged parallel to the river, and the works will ultimately consist of two sets of six tanks each, or twelve in all. The sewage enters the tanks at their eastern end, and the clarified effluent passes out at the western extremity into a channel discharging into the river. Storm overflows have been provided, which only come into use when the rainfall doubles the average daily flow. The works in their future full extent are designed to deal with a dry-weather flow of 40,000 cu. metres, and a wet-weather flow of 80,000 cu. metres. The whole treatment may be subdivided into four stages. The sewage enters at its normal rate of flow into the sand intercepting chamber, and the speed is then retarded to $\frac{1}{10}$ of the velocity in the main sewer. In this tank the heavier suspended impurities are deposited, and the water, after passing under scum-boards which retain the floating matters, and through strainers which remove the more bulky matters, passes into the mixing chamber, where the requisite proportions of precipitants are added. It passes next along a conducting-channel into the separate tanks, where the velocity is further reduced to $\frac{1}{100}$ of the original velocity. In the four tanks of the first group at present completed, the capacity has been so calculated that the sewage takes six hours to pass through them. They are 80 metres long, and 2 metres deep at the inlet end, while they gradually slope down to 3 metres deep at the outlet. The total volume contained in each tank is 1,100 cu. metres; the velocity at the inlet is 5 millimetres per second, and at the outlet end 3 millimetres per second, or a mean speed of flow through the tanks of 4 millimetres per second. As a rule, all the four tanks are in work at once, but the inlet channels are so furnished with sluices that any one tank at will may be stopped off for the purpose of emptying out the sludge. To effect this, the supernatant water can be drawn off at three different levels, and the sludge may then be pumped out. Each tank is cleaned out once in 8 days, so that every second day one of the tanks is emptied—a process which occupies about 5 hours. The sludge is of so liquid a consistency that the fall of 1 metre in the length of the tank suffices to convey it by gravitation to the suction-pipes of the pumps at the deeper end. The entire aggregate power of the pumps and mixing machinery is 40 H. P.

The precipitants employed are lime and sulphate of alumina; the latter, procured from Duisburg, contains 14 per cent. of pure alumina. The chemicals are proportioned to the volume and the amount of impurities present in the sewage. The volume is ascertained by self-indicating arrangements of a float; the impurities by a scale of eight separate degrees above a fixed standard. The average amount of precipitants made use of is 1 ton of sulphate of alumina to 6,000 cu. metres of sewage water, and the proportion of lime added is to the alumina sulphate as 1 to 4.

Numerous experiments have been conducted to test the relative values of the lime and the alumina, and the efficiency of precipitation as contrasted with simple deposition in tanks; and tables too long for abstract, accompanied by graphic representations of the results, are given. Five sets of experiments have been carried out—three with lime and sulphate of alumina, two with lime, and one without chemicals. The analyses have been made by Dr. LEPSIUS, and the bacteriological investigations were conducted by Dr. LIBBERTZ.

The chemical results show the vast improvement in the quality of the effluent due to the entire removal of the suspended impurities, and by the use of the alumina, of 40 per cent. of the organic matters in solution.

As respects the bacteriological tests, Dr. LIBBERTZ reports that, where the average number of germs capable of development in the cubic centimetre of raw sewage was 3,000,000 (as compared with from 4 to 5 million germs usually present in the sewage-water of other large towns), the effluent water, after the sulphate of alumina treatment, contained but, in round figures, 380,000 germs per cu. centimetre; after the lime treatment, 17,500 germs; but after simple deposition, 3,350,000 germs per cu. centimetre.

The author sums up the advantages and disadvantages of the various precipitants used, and states that the use of lime was found to increase the bulk of the sludge 3½ times beyond that obtained by the alumina treatment.

The total costs have been as follows:

	Marks.	£
For land about	200,000 =	10,000
For works: tanks with inlet and outlet channels	435,572 =	21,775
Engine and pumping station	73,795 =	3,689
Machinery	28,818 =	1,441
Plant	6,589 =	330
Siphon under main	76,530 =	3,826
Office and other expenses	47,582 =	2,379
Total	668,836 =	33,440

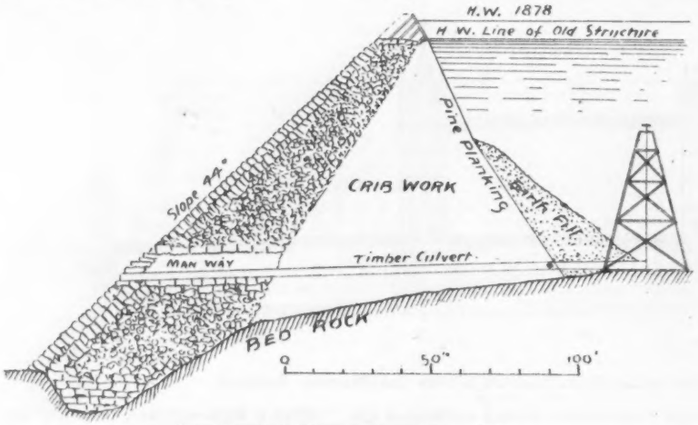
The annual cost of treatment amounts to 150,000 marks or £7,500; or about 1 shilling per head of population, or 1¼ pfennige per cu. metre of sewage-water.

*By W. H. LINDLEY, M. Inst. C. E., in "Deutsche Vierteljahrsschrift für öffentliche Gesundheitspflege," 1889, p. 71, from "abstracts of papers," Inst. C. E.,

The English Dam, Sierra Co., Cal.; Destroyed in June, 1883.

In a well written article on "Dams Which Have Burst" the *Mining and Scientific Press*, of San Francisco, describes the English dam in Sierra Co., California, which broke on June 18, 1883. From it we make the following abstract:

This dam was built by the Milton Mining Water Co., in 1856-58, on the head waters of a tributary of the Yuba river at an elevation of 6,140 ft. above the sea. This reservoir covered 395 acres and impounded 650,000,000 cu. ft. of water. The dam was 331 ft. long on the crest, 50 ft. long at the bottom, and 100 ft. high at the center. The original dam was a tamarack crib filled with stone, with a bottom width of 100 ft. (measured through the culvert) and a vertical height of 79 ft. above datum on the inside face. It was covered with a heavy pine planking, forming a water-tight lining.



The English Dam, Sierra Co., Cal.

The North Bloomfield Gravel Mining Co. then bought this dam, and as it had no immediate use for the water, the waste-way of the dam was cut down 8 ft. At this time a small amount of water was observed flowing from under the crib at the middle of the dam, and earth was taken from the sides and filled in on the inside of the dam to stop the leak, as shown in the cut. In 1876-7 the outer face was overhauled, and decayed parts of the crib replaced with new timber.

To increase the capacity of the reservoir, the crest had to be raised, and the outer face was strengthened by a stone facing. To put in this facing a tramway was built along the crest leading to a quarry about one mile away, and the rock was brought to the dam, an outer face of dry rubble laid up on a slope of 44°, and the intervening space solidly filled by dumping stone from the cars. The material used was a sort of tufa of 2.4 to 2.6 specific gravity, the best that could be secured. It was estimated that in the quantity used the ratio of the dead weight to the pressure on the bottom of the dam was as 19,200 lbs. to 5,400 lbs. per square foot, which made the new dam stronger than the old one.

In 1878, when this stone-work was completed to within 7 ft. of the intended crest, a substantial piece of timber-work, thoroughly braced, was raised on top of the dam, bringing it up to the full intended height. The improvement cost $70,000 and the high-water mark was raised to 86.73 ft. above the bottom of the inner mouth of the culvert.

The dam was examined daily, and on the day of the breakage the water was within 16½ ins. of the crest, so it still required 2¼ ins. to reach the waterway or high-water level. Early in the morning the watchman heard two violent explosions, and then saw the water pouring through an opening in the upper timber work over the crest of the stonework. In a few moments the crest in the center of the dam for a length of 175 ft. was swept away, and an immense opening soon cut to its very foundation. In the space of one hour fully 600,000,000 cu. ft. of water was discharged into the cañon below, at the rate of over 166,000 cu. ft. per second. In an hour and a half from the time when the explosion occurred ,the reservoir was emptied of its entire contents of 650,000,000 cu. ft. of water.

This immense volume of water rushed into the cañon below the dam, which for the immediate distance of 1,000 ft. has an average width at the high-water level of the dam of 300 ft. and a bottom width of 100 ft.

Mr. AUG. J. BOWIE, the well-known mining engineer of San Francisco, read, before the Technical Society of the Pacific Coast, a paper on the destruction of this dam, in which he brought together many new and interesting facts concerning the speed of a body of water suddenly set free in the manner described, and from this paper the following is quoted:—

The cañon has a grade of 500 feet to the mile, and was entirely denuded. The first indications of any deposit from the stone in the dam are observed at a point about 1,500 feet below it. Here the cañon widens, and a deposit, which is 8 or 10 feet high, composed of gravel, mud, and rock, extends along the south side some 500 or 600 feet. Stones of various dimensions, containing as much as 4 or 5 cu. ft., are observed to have lodged here.

As soon as the break occurred, the news was telephoned along the line, and every one that could be reached along the river was notified of the coming waters.

There are many places in the cañons of the middle Yuba where the flood is believed to have reached a height of from 75 to 80 ft., and it was observed by those who saw the rush in these places, that the face of the torrent was a mass of timber and trees, no water being visible.

At Freeman's Bridge, 43 miles below the dam, which point it reached at 9 30 A. M., a rise of 40 ft. was reported. The water reached the Narrows, a short distance above Smartsville, and 65 miles from the dam, having descended 5,850 ft. (baro. obs.) in 6 hours and 15 minutes, or at a miles per hour, or 15.25 ft. per second. Here the river is 285 ft. wide at the water-line, and the rise due to this flood was reported to be 35 to 40 ft. This rise was due to the accumulation of timber and trees which held back the water.

At Point de Guerre, 70 miles below the dam, the river is a mile wide, and in 15 minutes it rose 2¼ ft. wi h strong waves washing the shore. This place is 6,020 ft. below the dam. The average velocity of the flow of the first wave to this place was 9.65 miles per hour, or 14.16 ft. per second. Below Point de Guerre a levee was broken and a large volume of water passed over some miles of farming country, destroying, however, only about $4.000 worth of property.

At Marysville the indicated rise was 2 ft. 8 ins. at the highest. From the dam to Marysville is 85 miles, and the wave traveled to that point at an average speed of 8¼ miles per hour, or 12 46 ft. per second: or from Point de Guerre, 6.66 miles per hour, or 9.77 ft. per second, and from Smartsville to Marysville 6.15 miles per hour, or 9.01 ft. per second.

The final observation of this flood was made at Sacramento, 140 miles distant from the dam, or

From Smartsville	75 miles.
From Point de Guerre	70 "
From Marysville	55 "

Elevation of Sacramento above mean sea level at low-water level, 6 ft. Total grade or fall from dam, 6,134 ft.

The gauge at foot of K street, on the Sacramento river, registered at 6 P. M., June 18, 1883, 14 ft. 4 in. The first indication of the arrival of the water from the dam was the appearance of muddy water at 6 A. M., June 19. At 8 A. M. the gauge indicated 14 ft. 9 ins. From 2 to 3 P. M. the water was extremely muddy. At 4 P. M. the gauge read 15 ft., at 5 P. M. it registered 15 ft. and ½ in. which was the maximum height of the wave. At 6 P. M. the gauge stood 15 ft.; at 7 P. M., 14 ft, and 11½ ins.; at 7.30 P. M., 14 ft. 11 ins.; and at 8 A. M., June 20, it registered 14 ft. 2 ins., or 2 ins. below its register of June 18th.

The total time occupied by the wave in passing Sacramento was 26 hours, and assuming that the entire quantity of water from the dam was discharged by 6.15 A. M., June 18, the mean between 5.30 and 7 A. M., when the dam was entirely emptied, the average velocity of the flow between the dam and Sacramento was 3.8 miles per hour, or 5.58 ft. per second.

An Economical Method of Prospecting in Soft Ground.*

IT frequently happens that the mining engineer is called upon to conduct prospecting work; that is, to determine whether a certain indicated deposit of mineral is of sufficient value to justify the undertaking of permanent mining operations as a probably profitable investment. The position of the ore-body may or may not be known, but its extent and the quality of the ore is as yet questionable. It is, of course, to the advantage of both property owner and engineer that these two essential elements be determined as fully as possible, in the most expeditious manner, and with the least outlay of capital.

The manner in which such work has generally been conducted has been by means of adits (where possible), shafts and drifts. This method is expensive in proportion to the nature of the ground in which the work is located. The value of the deposit being unknown, it may be inexpedient to make such a large outlay of capital in preliminary work as the nature of the ground and the difficulties to be encountered would demand, especially as this outlay is liable to be a total loss, which is frequently the case. At the same time the engineer is unwilling to give his approval to inferior, more economical, and more dangerous work.

In more recent years the diamond drill has played an important part in prospecting for ore, nor is its value in such work yet fully appreciated. By its use one may prove the extent and quality of a deposit almost as well as with a shaft and at one-fourth of the expense. The diamond drill is, however, inapplicable to soft ground, clays or gravel, in which many of our beds of limonite, manganese, and manganiferous iron ores occur. Drifting and shafting in such ground being costly, until the value of the deposit is shown, it is advisable to use a more economical system if possible.

The writer was recently called upon to conduct such prospect work as above outlined, and as a result adopted the plan which is given here. The immediate object of the search was a bed of brown hematite containing manganese, which was known to exist in the vicinity. The character and quality of the float-ore found gave promise of a valuable deposit, could it be found. From the geological structure and the topography of the surrounding country, the position in which this body of ore should be was located within reasonable limits. The character of the ground was an alluvial deposit, consisting of alternating strata of gravel, sand, clays, and ochre.

The shaft was first started, but the amount of water entering soon proved that the expense of pumping and the heavy timbering required would hardly be warranted by the knowledge of the ore already gained. An adit was also started which would strike the supposed ore-bed at a depth of about 75 ft. from the surface. The clay strata, however, on being exposed to the air and infiltration of water necessitated such expensive timbering that this also became a serious question from an economical point of view.

The plan of prospecting finally adopted was that of boring vertical holes with an artesian well drilling machine. Such a machine was found, built upon the same principle as an oil-well drilling outfit, but on a smaller scale, capable of drilling to a depth of 250 to 300 ft.

In this machine the high derrick is replaced by a stayed mast 30 ft. in height, at the top of which is a grooved pulley or sheave, over which passes the cable to which are attached the tools. The tools consist of an augur stem, jars, and drill proper, in all respects similar to those for deep wells, the

* BY FERD. S. RUTTMAN, in *School of Mines Quarterly*, April, 1889.

weight, however, being proportioned to the size of the machine and the limited depth.

Instead of a walking beam, the tools are lifted by a cam (which is keyed upon the main driving shaft) striking a lever to which is attached a pulley through which passes the cable; another pulley, placed near the fulcrum of the lever, diminishes the wear of the cable to a minimum.

A sand reel, line, and pump are provided, the reel being worked by a friction belt connected with a pulley on the main shaft. Suitable gear for raising and lowering the tools is attached to the machine. The whole can be taken apart easily so that the heaviest part may be carried by two men, thus being easily conveyed from place to place as occasion requires; finally the machine is easily driven by a four-horse-power engine.

The machine being placed in position and the tools attached, the drill hole is started by allowing the tools to drop and strike against the ground, care being taken to keep the hole vertical. The drop is either 10 or 14 ins. as desired. When two or three feet in depth have thus been drilled, the tools are raised, the sand-pump is brought into requisition, and the hole emptied of its mixture of churned up clay and water.

After repeating this operation until a depth of 10 or 12 ft. has been obtained, it is best, if the ground be soft, to put in the well casing. This consists of heavy iron pipe provided on the lower end with an annular steel shoe with a sharp cutting edge. A heavy drive cap is screwed upon the upper end, upon which the maul or pipe driver descends. This maul is merely a log of wood 8 or 10 ft. long and 12 ins. in diameter, attached to the cable, and dropped by the same means as the drill. Having driven the length of pipe down, the cap is taken off and drilling resumed through the pipe, the drill being small enough to pass through the pipe, the difference between the hole bored by the drill and the outside diameter of the pipe being cut down by the shoe and raised to the surface.

By means of the sand-pump, samples of all the strata can be brought up for examination or assay, the condition of the material varying from slimes to pieces an inch or so in diameter, amply sufficient to detect the character of all the material through which the drill passes. Upon reaching the ore body or rock, the casing need not be continued further, as there is slight danger of the sides of the hole caving in.

The cost of a machine and engine adapted to the work above described is about $800 to $900, including drive-pipe 6 ins. in diameter. It is easily managed by two men, though in a rough country, it is advisable to have an additional man to cut fuel, assist in changing tools, etc. From 10 to 40 ft. per day can be driven through sand and clay. A depth of 80 ft. has been obtained in a 10-hour shift, though this is unusual. The cost of drilling varies from 50 cts. to $2.00 per ft., according to the nature of the ground. This cost does not include the cost of the pipe, but as this may be drawn up and used again, the added cost per foot is small. In cases where the quality of the ore proves it of little value, this method proves the fact at a small expense. Where the deposit is proved of value, the additional expense is a small factor in the general cost and is often over-balanced by the information obtained, which is of great importance in planning permanent operations.

When it is considered that much of the geological structure of western Pennsylvania has been determined by the material brought up from oil-wells by the sand-pump, the value of this method of prospecting may be better realized.

The Treatment of Steel by Hydraulic Pressure.

At the meeting of the Institution of Civil Engineers, on May 7, the paper read was on "The Treatment of Steel by Hydraulic Pressure, and the Plant Employed for the Purpose," by Mr. WILLIAM HENRY GREENWOOD, M. Inst. C. E. Attention was directed in the paper to the presence of blowholes in steel ingots, also to their origin, and to the various methods proposed for the production of sound ingots; but the author treated more especially of the method, the effect, the advantages, and the development of fluid compression, as applied in the plant and 10,000-ton press erected by him at the Abouchoff Works, St. Petersburg. It was assumed that molten Bessemer, open hearth, or crucible steel, possessed the quality of occluding a considerable volume of gases, especially of hydrogen and nitrogen, derived all or in part from the products of combustion in the furnace, or from other sources; and that, under ordinary conditions as to pressure, such occluded gases were, more or less, completely evolved at the moment when the particles of metal changed from the liquid to the solid state, and were thus imprisoned within the ingot in the form of bubbles of various forms and dimensions.

A second source of unsoundness arose from the contraction of the metal within the ingot after its outer skin had solidified, producing contraction cavities; and, lastly, the metal from ingots as usually cast was weak along the surface, owing to the development of a radical acicular structure in the cast metal. The combined effect of these three causes was that ingots of mild steel, such as were used in the construction of ordnance, large engine shafts, or other heavy forgings, for cylinder liners, torpedoes, and war material, contained cavities necessitating the rejection of about 30 per cent. from the head or top end of each ingot; while, to get rid of the surface honeycombs and weak acicular structure, which caused unclean, seamy, and roaky forgings, an additional 10 per cent. to 20 per cent. of metal had to be left for turning and machining to waste. Even after these losses of material, the remaining metal was inferior to the same metal after fluid compression.

The method of fluid compression claimed, then, to save the whole of the rejected head or top of the ingot, to reduce to a minimum the amount of metal to be left for turning or machining from the surface of forgings, and to produce for any temper of metal a greater amount of ductility, homogeneity, and reliability than was obtainable under the best conditions of casting in open moulds without pressure. The additions of increased proportions of manganese and of silicon did not commend themselves to the author for the classes of steel under consideration; for, although promoting solidity of the ingot, they hardened, raised the elastic limit and ultimate tensile strength, but lowered the ductility and general reliability of the metal.

Of the mechanical devices for increasing the solidity of steel ingots, the author noted the proposals for the cooling of the outside of the moulds, for agitating the metal during solidification, casting the metal in a vacuum, and the direct application of pressure, by the use of high-pressure steam, injection of water, of explosives, of solid carbon dioxide, etc., upon the surface of the fluid steel in closed moulds. These methods of fluid compression had all failed from mechanical, physical, and practical difficulties in their conduct; and the plan suggested by Sir HENRY BESSEMER in 1856, but quite independently developed and carried to a successful issue at the works of Sir Joseph Whitworth & Co., and now known as the method for the fluid compression of steel, remained the only one before the public which yielded ingots of mild steel of practically uniform molecular structure, strength, and ductility throughout their whole length.

The ordinary cast-iron moulds, or wrought-iron casings, lined with brick or moulding cement, could not be used when aggregate pressures of thousands of tons were to be exerted upon the surface of the fluid metal; but such moulds were replaced, in the fluid compression process, by built-up steel moulds, lined with suitably-grooved cast-iron lags, protected by a coating of refractory silicious material. A loose plate of the diameter of the ingot fitted in the bottom of the mould, and was protected by an upper covering of burnt fireclay segments, and a similar plate was carried upon the top plunger of the press for closing the top of the mould.

The paper traced the development of the hydraulic press for the fluid compression of steel, commencing with the erection in 1866, in the works of Sir Joseph Whitworth & Co., of a 250-ton press with the 12 in. cylinder, designed more especially for the compression of the metal for steel shells. In this the mould, which was partially filled with metal, was carried in a middle head of the press, whereupon a core, carried on the top head of the press, was forced into the fluid metal, at the same time closing the mouth of the mould. After this the pressure was applied from below, as in all the subsequent presses. Following this came a much more useful 2,000-ton press, with two columns and a 30-in. hydraulic cylinder. The next press, also erected at Manchester, had four steel columns 12 ins. in diameter, and was fitted with five pressing cylinders, namely, four of 28-in. diameter, and one of 13-in. diameter, capable of producing together a pressure of 8,000 tons. This 8,000-ton press was placed second by the author's erection in Russia of the press upon the lines of the Whitworth patent of 1874. This press had four screwed columns of 16-in. diameter, and one hydraulic pressing cylinder of 50-in. diameter, capable of exerting a gross pressure of 10,000 tons. For working the press, an accumulator, giving a pr
two tons to the square inch, was employed. The pressing was continued as long as there was any perceptible shortening. The maximum pressures attained ranged from four to twelve tons per square inch on the metal, and were maintained for from forty-five minutes to three or four hours, according to the size of ingot and the condition of the metal. The contraction in length during the application of the pressure usually amounted to about 1⅝ in. to the foot of length.

The author's experiments upon sound samples of crucible steel containing 0.54 per cent. of carbon gave a specific gravity of 7.8542 for the unpressed metal, as against a mean of 7.8795 for specimens of the same metal after fluid compression. In order to compare the behavior of the pressed with the unpressed metal, made from similar materials, and in the same manner, the two ingots of eight tons each were cast of open-hearth steel. The unpressed ingot contained carbon 0.5 per cent., and manganese 0.35 per cent.; it was 30.75 ins. in diameter, and 82 ins. long. The second was a similar ingot, but containing carbon 0.39 per cent. and manganese 0.4 per cent.; it measured 70.5 ins. in length after fluid compression, or 79 ins. as cast; it was 34.25 ins. in diameter. A slab of 4.75 ins. in thickness and of the full length and width of the ingot, was obtained from the center of each by parting each ingot longitudinally into three pieces on the planing machine. The surfaces so obtained presented much unsoundness in the unpressed ingot, while the pressed ingot was quite sound on both faces. The central slab from the pressed ingot was cut up into seven series of test pieces in such manner that ninety-eight test pieces were prepared from it, but only five series, or seventy test pieces, were obtainable from the unpressed ingot.

	Mean of the test-pieces cut longitudinally			
	Elastic limit in tons per sq. inch.	Ultimate breaking strength in tons per sq. inch.	Contraction in area at point of fracture	Elongation in 4 ins.
Unpressed ingot.....	11.11	29.18	P. cent. 4.41	P. cent. 8.76
Pressed ingot.....	11.45	29.53	7.99	12.51

The result, as derived from the test-pieces cut transversely, compared equally favorably. The test pieces

	Mean of the test-pieces cut transversely			
	Elastic limit in tons per sq. inch.	Ultimate breaking strength in tons per sq. inch.	Contraction in area at point of fracture	Elongation in 4 ins.
Unpressed ingot.....	11.43	28.01	P. cent. 3.61	P. cent. 7.91
Pressed ingot.....	12.38	30.07	7.57	12.74

were cylindrical, with collars, and the metal was not subjected to any hammering, annealing, hardening, or other treatment, excepting machining, after it came from the ingots. The pressed ingot gave its highest breaking strength in the upper sections, while the unpressed ingot, on the contrary, was at its best towards the bottom, and showed a rapid falling away at points exceeding one-half of the length of the ingot from the lower end; and, while the elongation amounted to 12.4 per cent. in the lowermost of the tests from the unpressed ingot, it fell rapidly away towards the upper part, so that in the fifth series the mean elongation was only 2.02 per cent. The pressed ingot, on the other hand, gave a mean elongation at its lowest point of 13.7 per cent., decreasing somewhat in the succeeding series; but still, at the very top of the ingot, the elongation was represented by 11.63 per cent. The figures further indicated that, in the unpressed (where sound) and also in the fluid-compressed ingots, the mean value of the elastic limit, as also of the ultimate breaking strength of the material, was slightly greater in the metal towards the outer boundary of the ingot, and tended to decrease towards the center. The paper concluded by referring to the effects of annealing and forging upon pressed steel, with tests from various gun-forgings, and of shell-metal in its soft and hardened state, as also after firing at armor-plates.

THE ALLEGHENY RIVER WATER is all right, says Dr. J. G. MCCANDLESS of the Health Bureau. Samples were taken by Prof. HUGO BLANCK from the river at the intake, from the reservoir, and from a hydrant. The water was in a bad condition for a few days after the Johnstown disaster, but the chemist says it is now better than the spring and well water being used as a substitute for it.

THE NICARAGUA CANAL is causing a row between Costa Rica and Nicaragua. It is a question of prospective canal tolls; but nothing serious is at present apprehended.

Final Report on the Proper Relation to Each Other of the Sections of Railway Wheels and Rails.

(Concluded from Page 569, Vol. xxi.)

[The report is accompanied by the following appendix, which really forms a part of the report.]

The committee sent out on April 20, 1889, the following circular of inquiry, supplementary to another circular of date March 18, which was substantially identical except as explained in the body of the circular:

[This circular was published in full, with cuts of rail-sections, in ENGINEERING NEWS, May 11, 1889].

The responses to the question asked as to the Michigan Central section, Fig. 1, are summarized in the body of this report. To the question as to the Lehigh Valley section, Fig. 2, the responses capable of summary were:

Disapprove unconditionally 22
[AXTELL, BARNES, BLACKWELL, BONZANO, BOUSCAREN, BRERETON, BURPEE, CARTER, DARLINGTON, DELANO, FLETCHER, GIBBS, HAZLEHURST, HITCHCOCK, HOYT, JOHNSON (T. H.), LANDRETH, LOREE, MERRIMAN, SEARLES, SNOW (J. P.), STONE.]

Disapprove by implication (answered first circular, in which this question was not specifically asked, in favor of the main features of the Michigan Central section) 20
[BECKER, BROWN, BRIGGS, CROSBY, CURTIS, DEFREES, DUDLEY, FORSYTH (William), HAWKS, HOWE, JONES, KATTÉ, MAN, MCDONALD, MORRIS, NEWELL, PENFIELD, PONTZEN, RICHARDS, WHITCOMB].

Disapproves, but likes high head [CROWELL] 1
" " 10-inch top radius [FORSYTH (Robert), RICHARDS] 2
Disapproves, but likes the flare [WHITE] 1

Total disapproving Lehigh Valley action 47
Total approving [BAKER, MILHOLLAND] 2
Non-commital [HINCKLEY, KINGMAN, ROBINSON, SWIFT] 2
[Messrs. HINCKLEY, KINGMAN, and ROBINSON are, by implication, disposed to favor Fig. 1 rather than Fig. 2, but do not so respond categorically.]

To the question as to the George's Creek and Cumberland section, Fig. 3, there is but one favorable response, that of Mr. MILHOLLAND, and that approves it only for roads of excessive curvature. Three others [BAKER, HINCKLEY, SWIFT] approve the corner radius. All other responses disapprove the section, many of them with emphasis.

Question (1) of the circular referred to the following summary of conclusions (the first one being slightly modified in form to make its intended meaning more clear) as to the cause of flange wear, from Page 28 of the Committee's Preliminary Report.

First.—That a tendency to eventually wear to a sharp flange is a natural phenomenon, which would exist and must exist in all perfect and perfectly running wheels, if there were no specific causes for it, and which cannot be eliminated by any form of rail or wheel.

Second.—That imperfections of diameter of wheels or of trucks, or both, give a tendency to run to one rail or the other to nearly all axles, relieving half the wheels of flange-wear tendency, and aggravating that of the other half.

Third.—That the quality of the wheel then has an enormous effect on the number of sharp flanges, causing many more when the fillet-chill is softer than the tread.

Fourth.—That when the wheel is sound and the quality even, about half the wheels get sharp flanges, while this proportion is reduced as the number of special defects increase, which cut short the life of the wheel before it is worn out.

Fifth.—That wheels which fail from flange wear are among the most durable, approximating to, if not exceeding, the life of those which fail from long-continued tread wear only, without developing other defect; so that no appreciable money loss results from wheels running to flange instead of failing from tread wear only.

To the question as to approval of this summary of laws of flange-wear, the responses were:

Approving unconditionally 30
[AXTELL, BAKER, BARNES, BOONE, BOUSCAREN, BRERETON, BROWN, BRIGGS, CARTER, CROSBY, CROWELL, DELANO, FLETCHER, FORSYTH (Robert), GIBBS, HAWKS, HITCHCOCK, HOYT, HOWE, JOHNSON (T. H.), LANDRETH, MAN, MCDONALD, PENFIELD, SEARLES, SNOW (J. P.), STONE, SWIFT, THOMSON, WHITCOMB.]
Approving, with comments and limitations, chiefly referring to the ambiguous original wording of the first statement, which is corrected above 7
[BURPEE, DUDLEY, KATTÉ, MERRIMAN, MILHOLLAND, PONTZEN, WHITE]
Approving, with limitations as to the fifth [CURTIS] 1
Approving all but the first [FORSYTH (William)] 1
Approving, with doubts as to third, fourth and fifth [BECKER] 1
Approving by implication, but not answering categorically 11
[BLACKWELL, BUCHANAN, DARLINGTON, DEFREES, HAZLEHURST, JONES, LOREE, NEWELL, OTIS, RICHARDS, VOORHEES.]

Total approving unconditionally or in substance 51
Disapproving unconditionally 0
"Generally, no" [BONZANO] 1
Disapproving for the most part, although approving in part 3
[HINCKLEY, KINGMAN and ROBINSON.]
Total disapproving 4

Question (2) of circular above was as to approval or disapproval of the Committee's preliminary conclusion, expressed in the *italicized* words of the following quotation, from page 35 of its Preliminary Report:

If we remember in connection with the records just given: (1) That they included both inside and outside rails, only the latter showing a tendency to flange wear; (2) That the rails on the sharper curves were much younger than on the easier ones, so that the full contrast had not developed, and (3) That the rate of tangent rail-wear of the same rails seemed rather to decrease with age, these figures seem to your Committee to be strong evidence that *the rate of rail-wear grows very materially greater as the rail corner is rounded off to fit the fillet of the flange.*"

The responses showed:

Unqualifiedly accepting the conclusion 41
[AXTELL, BAKER, BARNES, BECKER, BLACKWELL, BONZANO, BOUSCAREN, BRERETON, BROWN, BRIGGS, BUCHANAN, BURPEE, CARTER, CROSBY, CROWELL, DELANO, DUDLEY, FLETCHER, FORSYTH (Robert), GIBBS, HAWKS, HITCHCOCK, HOYT, HOWE, JOHNSON (T. H.), KATTÉ, LOREE, MAN, MCDONALD, MERRIMAN, MILHOLLAND, OTIS, PENFIELD, PONTZEN, RICHARDS, SNOW (J. P.), SNOW, THOMSON, VOORHEES, WHITCOMB, WHITTEMORE.]
Accepting conclusions with certain comments or limitations not appearing to affect the substance [HINCKLEY, SEARLES, WHITE.] 3
Accepting conclusion by implication from other answers as to form of rail sections, but not answering categorically 8
[DARLINGTON, DEFREES, FORSYTH (WM.), HAZLEHURST, JONES, KATTE, NEWELL, SLOAN.]
Total accepting conclusion explicitly or in substance 52

No by implication [HINCKLEY, KINGMAN, ROBINSON] 3

Total not accepting the conclusion 3
Doubtful or experimenting [CURTIS, KATTE, LANDRETH] 3

[Mr. HINCKLEY sends in an individual discussion, which appears to differ slightly from the joint one sent in by Messrs. HINCKLEY, KINGMAN, and ROBINSON. He is therefore classed on both sides of the above list, negativing his vote.]

Question (3) above, as to whether the engravings on pages 38 and 39 of the Preliminary Report (reproduced herewith), with personal observation and experience, warrant the conclusion that "worn rails in service take a top radius of about 12 ins., seldom much more or less, and a corner radius of about ¼-in., or somewhat more," is answered as follows:

12-in. top radius 37
[AXTELL, BAKER, BARNES, BECKER, BONZANO, BOUSCAREN, BRERETON, BRIGGS, CROWELL, CURTIS, DELANO, FLETCHER, FORSYTH (Robert), FORSYTH (William), HAWKS, HINCKLEY, HITCHCOCK, HOYT, HOWE, JOHNSON (T.H.), JONES, KATTE, LANDRETH, LOREE, MAN, MCDONALD, MERRIMAN, MILHOLLAND, PENFIELD, RICHARDS, SEARLES, SNOW, (J.P.), STONE, SWIFT, THOMSON, WHITCOMB, WHITE.]
12 to 14 ins. [CARTER, GIBBS, KATTE] 3
12 to 16 ins. [DUDLEY] 1
12 ins. or less [BROWN] 1
12 ins. with conditions not affecting substance [BURPEE, PONTZEN] 2
12 ins. by implication [NEWELL] 1

Total agreeing that natural wear is to about 12 ins. radius 45
Dissenting, "wear nearly flat" [DARLINGTON] 1
Dissenting, without comment [DEFREES, HAZLEHURST, WHITTEMORE] 3

Total dissenting 4
Not prepared to answer [BLICKENSDERFER, CROSBY] 2

As to the second part of the above question, whether wear tends to maintain about a ¼ in. corner radius, the responses stand:

Yes, ¼-in. radius 24
[AXTELL, BAKER, BARNES, BECKER, BONZANO, BOUSCAREN, BRERETON, BRIGGS, CARTER, DELANO, FLETCHER, FORSYTH, (Robert), GIBBS, HAWKS, HITCHCOCK, HOYT, JOHNSON (T. H.), LANDRETH, LOREE, MCDONALD, MERRIMAN, MILHOLLAND, RICHARDS, STONE.]
Not over ¼ in. [KATTÉ, VORHEES] 2
Somewhat less than ¼-in. [BROWN] 1
Somewhat more than ¼-in. [HOWE, SNOW J. P.] 2
¼-in. + 1/32 [FORSYTH (Wm.), PENFIELD] 2
¼-in. to 1/32 [MAN, THOMSON] 2
¼-in. to 1/16 [SEARLES] 1
¼-in. with modifying comments [DUDLEY] 1
" ¼-in., ¼ to ⅜ " [HINCKLEY] 1
¼-in. to ⅜ [CURTIS] 1

Total answering about ¼-in. in substance 37
¼-in. [SWIFT] 1
Not proven [WHITE] 1

About twenty of the responses either omit to answer this question or explicitly state that they have not examined into the matter enough to feel justified in expressing an opinion.

Question (4) above is as to whether the views expressed in the following quotations, from page 44 of the Committee's Preliminary Report, are warranted by the evidence:

Is it desirable that the corner radii of rail and wheel in Figs. 9 and 10 should be nearly alike, or differ considerably?

So far as rubbing friction only is concerned, there will be less wear if they differ considerably; so far as crushing action is concerned, there will be less as the radii approach each other. As a whole, it seems probable to your Committee that the very minimum rate may be when the fillet and rail radii are nearly alike, but not quite; but that they should therefore be made so in the beginning appears more doubtful for the following reasons:

The evidence seems to be that, under all working conditions the rate of rail-wear is very much less before the conditions of Fig. 11 are reached than afterwards. It is therefore desirable to postpone the attainment of such conditions as much as possible. But if the radii be made nearly alike in the beginning, we have but little metal to wear away before the conditions of Fig. 11 are attained. In proportion as the corner is originally sharper, we have more. That is to say, if we take the total metal available for wear in the head at 10 lbs. per yd. or 1 sq. in., by using for the corner radius:

½-in. in place of ⅜-in. we add 14.08 per cent. to wearing sec.
" " ⅜-in. " 8.65 " " "
" " ½-in. " 3.35 " " "

If the preceding indications are correct as to this being very nearly the metal of slowest wear in the rail head, this is a serious loss, much larger than the above percentages alone indicate, and the question of which radius will give the lowest rate of wear in the new rail is less important than which gives the most metal to be worn away before the conditions of Fig. 11 obtain.

The responses stand as follows:

Approving unqualifiedly 32
[AXTELL, BARNES, BECKER, BONZANO, BOUSCAREN, BRERETON, BROWN, BRIGGS, CARTER, CROSBY, CROWELL, DELANO, DUDLEY, FLETCHER, FORSYTH (Robert) FORSYTH (Wm.), GIBBS, HAWKS, HITCHCOCK, HOYT, HOWE, JOHNSON (T.H.), KATTÉ, MAN, MCDONALD, MERRIMAN, PENFIELD, PONTZEN, SEARLES, SNOW (J.P.), STONE, THOMSON.]
Approving with limitations of minor moment 2
[CURTIS, LANDRETH.]
Approving by implication from other answers 9
[BUCHANAN, DARLINGTON, DEFREES, HAZLEHURST, JONES, NEWELL, RICHARDS, VOORHEES, WHITCOMB.]

Total approving 43
Disapproving explicitly 4
[BAKER, HINCKLEY, MILHOLLAND, SWIFT.]
Disapproving by implication 2
[KINGMAN, ROBINSON.]

Total disapproving 6

Question (5) above related to the views suggested in the following quotation from 45 of the Committee's Preliminary Report, which quotation follows immediately after the one last given:

"The same reasoning, if sound, applies conversely to the fillet radius of flange. The larger this radius, the longer will it take to wear away enough metal to bring about the conditions of Fig. 11. The most usual fillet radius some years ago was ¾ in., but ⅝ in. has lately been made standard by the Master Car Builders' Association, for the supposed purpose of approximating more nearly to the form of the rail-head, with some admitted disadvantage in manufacturing, because the smaller the radius, the more difficult it is to get a perfect chill in the fillet. If the preceding deductions are correct, a ¾-in. radius is rather to be preferred for all reasons; but there is no particular necessity from a mechanical point of view for having any single standard radius, either for rail or wheel (although, of course, it still remains highly desirable, for commercial and manufacturing reasons, to unify practice).

[To avoid possible misconception, which appears in some of the discussions, the Committee has deemed it wise to add the words in parentheses to this quotation.]

The responses in regard to this question are:

Regard the conclusions as warranted 36
[AXTELL, BAKER, BARNES, BECKER, BONZANO, BOUSCAREN, BRERETON, BROWN, BRIGGS, BURPEE, CARTER, CROSBY, CROWELL, CURTIS, DELANO, DUDLEY, FLETCHER, FORSYTH (Robert), FORSYTH (William), GIBBS, HAWKS, HITCHCOCK, HOYT, HOWE, JOHNSON (T. H.), KATTÉ, LANDRETH, LOREE, MAN, MCDONALD, PENFIELD, PONTZEN, SEARLES, SNOW (W. W.) STONE, THOMPSON.]
Approve by implication 12
[BUCHANAN, DARLINGTON, DEFREES, HAZLEHURST, NEWELL, OTIS, RICHARDS, THOMSON, VOORHEES, WHITCOMB, WHITE, WHITTEMORE.]

Total accepting conclusion, explicitly or impliedly 48
Dissenting explicitly 5

[HINCKLEY, KINGMAN, MILHOLLAND, ROBINSON, SWIFT.]

Dissenting by implication [BOONE, SNOW (J. P.)].... 2

Total dissenting... 7

The Committee submits these views, which it has gathered as to fillet radius, for consideration on their merits; but, inasmuch as there now exists a standard wheel section, which has come into extensive use, it felt that it was inexpedient in this report to recommend any change in the existing standard.

Question (6) above relates to the suggestion of an entirely flat top between the rounded rail corners. One vote on this question (approval or disapproval of a 12-in. top radius) is recorded in the body of this report, but as the vote on the direct question differs somewhat, it is here given, as follows:

In favor of a flat top 7

[BLACKWELL, DARLINGTON, DEFREES, HAZLEHURST, HOWE, MORRIS, WHITTEMORE.]

In favor with qualifications [CROWELL] 1
Inclined to favor a flat top [AXTELL, BAKER, WHITE] 3

Total favoring a flat top..... 11

Disapproving a flat top.... 36

[BARNES, BLACKWELL, BONZANO, BOUSCAREN, BRERETON, BROWN, BRIGGS, BUCHANAN, CARTER, CURTIS, DELANO, DUDLEY, FORSYTH (Robert), FORSYTH (William), GIBBS, HAWKS, HINCKLEY, HITCHCOCK, HOYT, JOHNSON (T. H.), JONES, KATTE, KINGMAN, MAN, MCDONALD, MERRIMAN, MILHOLLAND, PONTZEN, RICHARDS, ROBINSON, SLOAN, SNOW (J. P.), STONE, SWIFT, THOMSON, VOORHEESS.]

Disapproving by implication [LOREE, NEWELL].... 2
Disapproving for coned wheels; otherwise doubtful [CROSBY, WHITCOMB] 2
Total opposed to a flat top..... 40

Doubtful; "as nearly flat as possible, say 18 in."... 4
[BURFEE, FLETCHER, JOHNSON (J. B.), LANDRETH.]

The matter contained in this Appendix might with propriety have been included in the Committee's report, and is to be considered as a part thereof, but as it did not relate to their final recommendations, but only to premises on which to base such recommendations, the Committee concluded to confine its report to specific recommendations only.

The Guildhall Dinner to the American Engineers.

The banquet given by the Institution of Civil Engineers to the American engineers on June 13 was a memorable affair. The use of the historic Guildhall for this unique purpose induced the conservative London *Standard* to investigate, and it finds that never before, as far as the memory of the oldest members of the Corporation or the city archives can tell, has this hall been used for any purpose not directly connected with the Corporation. But in granting the use of this hall, the Lord Mayor saw fit to regard the occasion as one of a distinctly international character and acted accordingly.

Sir JOHN COODE, President of the Institution of Civil Engineers, presided, and aside from the visiting engineers we find among the guests the following names:

The United States Minister (Mr. ROBERT LINCOLN), Sir EDWARD THORNTON, Mr. AIRD, M. P., General HUTCHINSON, Mr. MATHER, M. P., Sir HENRY DOULTON, Rev. M. S. A. WALROND, Mr. FRANK GREEN, Sir WILLIAM THOMSON, Sir THOMAS CHAMBERS, General Sir RICHARD HARRISON, Mr. KIRCHHOFF, Sir GEO. B. BRUCE, the Dean of Westminster, Mr. ABERNETHY, Sir DAVID SOLOMONS, Sir JOHN FOWLER, Mr. WHITTEMORE, Lord STALBRIDGE, Sir LOWTHIAN BELL, Mr. Sheriff NEWTON, Lord ARMSTRONG, Mr. HENRY WHITE, Sir FREDERICK MAPPIN, M. P., General Sir MONTAGU M'MURDO, Sir ROBERT STUART, Sir JOHN MONCKTON, Sir FRED. ABEL, Sir A. M. RENDEL, Sir HENRY BESSEMER, Sir JAMES ALLPORT, General WEBBER, Archdeacon FARRAR, Prof. BOYD DAWKINS, and others.

The HON. ROBERT LINCOLN answered to the toast of the "United States of America," and in fitting terms returned thanks for the kind welcome and cordiality shown both himself and the American guests there present. He believed that engineers were doing more to promote the brotherhood of man than all the efforts of diplomacy.

DON J. WHITTEMORE, Past President American Society Civil Engineers, answered to "the Engineering Societies of the United States;" Mr. HENRY R. TOWNE, President American Society Mechanical Engineers, Mr. A. C. HUNT, Vice-President American Institute of Mining Engineers, and Mr. ELIHU THOMSON, President of the Society of American Electrical Engineers, answered each for the bodies they represented in short but telling speeches. Sir JOHN COODE then gave the toast of "The Corporation of the City of London and the City Guilds," in which he explained that he and his colleagues in asking for the use of this hall desired that as much *éclat* as possible should be given to the visit of the American engineers, and that, while it was a bold and unprecedented request to make, the Lord Mayor and the Corporation accepted their plea, and as a consequence they had the exceptional privilege of entertaining their guests in the grand old Guildhall of the City of London. Mr. NEWTON, Sheriff of London, answered to this toast. Mr. T. C. CLARKE, in submitting the last toast, "The Prosperity of the Institution of Civil Engineers," expressed the gratitude of himself and his American colleagues for the warmth of their reception and promised that when the British Institution visited America—as he hoped they soon would—that they would find extended to them a grasp as true and hearts as warm as any the Americans had met in England.

The Water Jet in Pile Driving.

In describing the Calais harbor works lately completed, our contemporary, *Engineering*, speaks as follows of the use of the water jet in sinking piles:

The engineer in charge of this portion of the work sunk all the piles with the help of water jets,—a system which has, of course, been in use for many years for sinking cylinders and iron piles, but which, we believe, had never been previously employed in this particular manner. The first trials were made in 1877, and the results obtained were so remarkable that the method was followed throughout nearly the whole of the work. Before this means was tried, the operation of driving a panel of sheet piling 9 ft. high and 6 ft. wide required 900 blows from a 1,300-lb. weight, and the average time occupied was 8½ hours. The sand offered so much resistance that the thickness of the piling had to be increased from 3 to 5 ins., and even then the wood was frequently broken. All these difficulties disappeared with the introduction of the water jet, which was forced into the sand by hand-pumps through a 1-in. nozzle connected to rubber tubes. Much wider panels could be lowered in this manner, and the time of sinking was reduced to about one hour, while in many cases the operation was completed in 15 minutes. The number of blows from the falling weight never exceeded 50, and were only necessary to overcome the friction between the adjoining panels, which were tongued and grooved so as to make a tight joint. As a rule, the weight of the 1,300-lb. hammer resting on the head of a 10-ft. pile sufficed to drive it almost instantly into its place.

We would remind our contemporary that the French engineers were anticipated in this method of sinking piling by American engineers and by at least 25 years in time. In proof whereof we would refer to an excellent historical sketch on "The Water Jet as an Aid to Engineering Construction," written by L. Y. SCHERMERHORN, C. E., and published by the Engineer Department, U. S. Army, in 1881. In this work the author shows that the piles for a wharf in Matagorda Bay, Texas, were sunk by means of a pump, a hose, and a gas-pipe nozzle—just as above described—in 1852. The suggestion is said to have been made by Lieut. GEORGE B. MCCLELLAN, then Engineer of the Department of Texas.

In 1854 piles for the foundation of Pungateague Light, in Chesapeake Bay, were so sunk by CHAS. PONTEZ, under the direction of Mayor H. BACHE, U. S. T. E. Sheet and bearing piles were put down by a water jet, between 1854 and 1861, in constructing the jetties for the protection of Fort Livingtson, La., by Lieut. W. H. STEVENS, U. S. Eng's. In 1862, 5,000 inclined wooden piles, from 18 to 30 ft. in diameter, were sunk 12 to 20 ft. in the sand of Mobile Bay to obstruct the entrance of Federal vessels of war. These piles were slung from the deck of a steamer by means of overhanging shears, and a hose attached to a steam fire-engine was led to a 1¼ in. fire-nozzle secured to the lower end of the pile by an iron staple. The hose and nozzle were pulled to the surface before the pumping ceased, and the piles are stated to have dropped to their place at the rate of "about 1 foot per second." The water was 8 ft. deep overlaying 20 ft. of hard sand.

The use of the water-jet in putting down both sheet and bearing piles was common in the United States thereafter. One of its special uses was in sinking palmetto piles, which effectually resisted the teredo but were too soft to permit driving with an ordinary hammer. The jet was used in 1872 and 1873 by Major P. C. HAINS and Capt. A. N. DAMRELL, U. S. Engrs., for placing piles for beach protection and sheet piling for sea walls. In 1867–69 Mr. O. CHANUTE, M. Am. Soc. C. E., sank single and compound wooden bearing piles by the water-jet in building the Kansas City bridge; and in the latter case he used four square piles with the inner corner chamfered off and thus provided an axial hole for the jet. In 1868, Mr. T. G. WHITMAN, Chief Engineer of the St. Louis water-works, applied the jet in sinking sheet piling. In 1870 Mr. E. D. MASON, Chief Engineer of the Hannibal bridge over the Missouri, used the water-jet to clear the heads of piles to be cut off and also to general deposits about the foundations; and similar successful results followed its application, in 1873 by Mr. C. C. MARTIN in the sheet-piling of the Brooklyn bridge.

But we think that enough has been said to prove the fact that French engineers were not the first to apply the water-jet to sinking either wooden sheet or bearing piles. For further data we would refer to Mr. SCHERMERHORN'S valuable memoir.

The Suez Canal.

The Report which was read by M. de LESSEPS June 5, at the annual meeting of the shareholders of the Suez Canal states that in 1888 the working expenses of the Canal were only 7,743,064f., whereas the gross earnings were 67,705,341f. Since the opening of the Canal the working expenses have also increased 2,500,000f., which is insignificant compared with the immense growth of the traffic, and in the total increase a sum of 400,000 fr. for the night navigation is included. From the gross earnings the sum of 31,433,901f. is deducted for charges of all sorts, including 5 per cent. interest on the shares and the redemption of capital. Of the balance of 36,271,447f., 12,676,056f. was distributed on Jan. 1, 1889, to the shareholders. The dividend for 1888 is, therefore, fixed at 64f. 38c. per share, or, with the 5 per cent. interest, at 89f. 38c. After the deduction of the coupon tax, the next income to be received on each share is 84f. 47½c.

This year nothing is placed to the credit of the reserve fund, but 300,000f. is set aside for new buildings, 480,000f. for the purchase of new tugs, barges, etc., and 60,000f. for minor plant; 3,440 transits of vessels through the canal produced 63,037,618f. The tolls paid on the 183,895 passengers amounted to 1,838,957f., and the accessory receipts for the transits of vessels were 366,045f. The total receipts for transit, amounting to 65,242,021f., are 7,117,245f. in excess of those of 1887, that is to say, an increase of 12¼ per cent. The number of ships which passed through the canal for the first time in 1888 was 192, or, compared with 1887, an increase of 20¾ per cent. In 1881 the number of vessels drawing more than 7m. of water that passed through the canal was 971, or about 28¼ per cent. of the total number. Of these, 105 drew 7.49m., and two drew 7.50m.

Night navigation on the canal was in 1888 had recourse to by 1,608 vessels, or about 46¾ per cent. of the total number of ships. In 1887 the average duration of the passage through the canal was 34 h. 3 min., which was a diminution of 2 h. 8 min. compared with the preceding year. In 1888 there was a further diminution of 3 h. 18 min., the average length of the passage being only 30 h. 45 min.

Concerning the improvement works, the Report states that during 1888 as many as 3,908,914 cu. m. of soil were removed. By the end of the present year the whole canal, from the Mediterranean to the Red sea, will have been given a depth of 8.5 m. below low water mark. At the same date 14 kilos of the canal will have been widened by 15 m. Next year it will be possible to make the first trials of two vessels passing each other in the canal without one of them stopping.

THE CONGO RAILWAY is before the Belgian Representatives in the form of a bill authorizing the Government to subscribe 10,000,000 francs for this purpose. The Chamber appears to be disposed to vote for it.

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D. McN. STAUFFER A. M. WELLINGTON
EDITORS.
CHAS. W. BAKER E. E. R. TRATMAN M. N. BAKER
ASSOCIATE EDITORS.
GEO. H. FROST . . . . . BUSINESS MANAGER

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Coming Technical Meetings.

Civil Engineers' Society of St. Paul, Minn. — Next meeting, Sept. 2. Secy., Geo. L. Wilson, City Hall.

Roadmasters' Association of America. — The annual convention will be held at Denver, Col., beginning Sept. 10 Secy., H. W. Reed, Waycross, Ga.

Boston Society of Civil Engineers.—Next meeting, Sept. 18. Secy., S. E. Tinkham.

OUR late prediction regarding the dangers of gasoline in case of a collision seems to have been speedily and unhappily realized in the disaster of July 2, on the Norfolk & Western R. R.; that is, if the following dispatch to the New York *Herald* is proven correct by later evidence. The *Herald* says:—

The engine, baggage, express, two passenger coaches and two Pullman sleepers went down. The locomotive boiler and a gasoline lamp exploded by the shock, and the entire train was wrapped in flames in an instant.

We already know by a letter to us from Mr. S. B. HAUPT, Superintendent M. P. of the Norfolk & Western R. R. Co., that the system of car lighting, lately objected to by us, was in use on that road, and that "so far, it had given satisfaction." This fact, taken in connection with "the gasoline lamp" that exploded, tells a story that scarcely needs any further comment, and would explain, as we have before pointed out, why "the entire train was wrapped in flames in an instant." We do not wish to be uncharitable in this matter, and will await the fuller investigation that must certainly follow before saying anything more on this subject. But as we wrote before purely out of regard for the public safety, in this same interest we trust that the connection of this gasoline lamp with the loss of twenty or thirty lives will be made clear. In this case, a boiler explosion accompanied the wreck, and this may have been the inciting cause of the fire; but if gasoline was actually present, as stated, no one who has any experience with it need be told of the fatal rapidity with which this inflammable gas would spread an otherwise comparatively harmless flame.

IN connection with the excellent work done by Mr. THEODORE COOPER in his paper on American Railway Bridges, abstracted in this issue, we would suggest to our readers that Mr. COOPER would be indebted to them for any corrections in facts, dates, or dimensions, and especially so for any additional matter relating to our earlier bridges. This is the first attempt at a systematic historical account of one of the most interesting branches of American engineering, and every engineer in this country should be interested in making the account as complete as is possible. The material is widely scattered, and it is only with the hearty sympathy and co-operation of the engineer everywhere that any one man can hope to accomplish the end in view. We make this request from not altogether unselfish motives, for a compliance with it will also enable this journal to assist in putting this information at the service of engineers generally by publishing that of most interest.

THE city of Paterson has just been enlivened by another of those disgraceful crossing wars by means of which railway corporations, from time to time, teach their employés how to manifest their respect for law and order in the next labor difficulty. The Delaware, Lackawana & Western is suspected of a desire to share the Erie's local traffic from Paterson. They obtained permission to lay a new spur parallel with the Erie's Newark branch for about two miles; and the prospect seemed so ominous, although still a mere vague possibility, that the Erie also suddenly discovered need for new tracks, and got authority for laying them. The Lackawanna, in blissful ignorance, was working on its new track, when the subsequent proceedings, which we may most concisely give in the picturesque words of the local reporter, began:

The Erie's men must have been watching the operations. At any rate, at daylight this morning a construction train, swarming with Italians and other laborers, equipped with picks, shovels, and crowbars, came down the Newark branch, and, as soon as the train was stopped the laborers proceeded to rip up the tracks and throw the ties down the embankment at this point. The part of the tracks that could not be torn up by the laborers was destroyed by hitching the locomotive to it with a large cable, and drawing it out of the way. By the time the work of destruction was about accomplished, the laborers of the Lackawanna began to arrive to go to work for the day, and when they saw what had been done by the Erie men, they were naturally enraged. Some of the more hot-headed men in the gangs got to fighting, and word was telephoned to the police station, when a large squad of police went down to Getty Avenue, under Chief GAUL, to maintain order. After destroying the Lackawanna's tracks the Erie men, 300 in number, began unloading the construction train of ties and rails, and laid three sections of track across Getty Avenue, in accordance with the permission that had been given the Erie by the Aldermen on Monday evening. This latter step, it is believed, will have the effect of blocking the Lackawanna. Only the presence of the police prevented a riot between the two forces of railroad laborers. The police are still at the scene, and will remain until all signs of trouble have disappeared.

In comparison with the Pennsylvania's proceedings a year or two ago, when a battalion of employés, under Major-General RICHARDS, Assistant Chief Engineer, used locomotives as artillery, these proceedings were rather tame, but then, the weather is not so hot just now as to incite to more inflammatory action.

IT is greatly to be regretted that an example cannot be made of some of the railway officials who provoke these conflicts. We mean, not the under-officials in immediate command of the opposing forces, but the presidents, general managers, and others, who are really responsible therefor. They are actually guilty of a penitentiary offence, as any private individual would speedily discover who should attempt, with a force of hired aids, to tear down the building of some neighbor, whom he might consider to have infringed, not his legal rights—for the Erie cannot imagine that it has any legal right to a permanent monopoly of the Paterson business—but his convenience and pleasure. The railways do not think of enforcing their rights against individuals in this manner, nor do individuals attempt to thus enforce their rights against railways or each other. But when railways have a quarrel, such resort to force is not occasional only, but is the customary course. As we said about two years ago, in discussing the need of the Interstate Commerce law, such violence is almost the sole survival in modern times of the methods and practices of the robber barons of the Middle Ages; and we hold that it springs from the same cause, viz., that the law is too weak either to protect or to control the railway corporations in their relations with each other, and hence that there is really nothing left to them in defining these relations but to resort to the

Good old plan
That he shall take who has the power,
And he shall keep who can.

In one sense, therefore, there is excuse for the railway officials who order crossing wars, as there was for the robber barons. They do not go to war because they love war, or want more than their own, but because, like Mark Twain's miner, they are "men of peace, and will have peace, if they kill every man in the room." It is time they were taught, however, that they have no rights, except those the law gives them; that the law is able both to protect and to control them; and that attempts to take the law into their own hands will entail prompt and condign punishment, for the manager as well as for the employé. We must not be thought to intend any disrespect to railway officers in again comparing some of their habits with those of the feudal lords. We hold that both were the victims of circumstances, and more especially of the weakness of the law. The barons meant well in the main, and did well in the main, that is to say, did more good than harm; but the time for their way of doing good is long since past, and so has the time for the action of railway officials who order the removal of track which does not belong to them by locomotives instead of by process of law.

ENGLISH engineers have opened their arms to their American professional brethren now in Europe with a fullness of embrace and a heartiness of manner that must weld still closer the bonds of craft fellowship between the two countries. From the moment their feet struck those hospitable shores, the Americans have met with a welcome far exceeding anything previously dreamed of, and in the banquet at the Guildhall we find that they have been accorded a distinction almost, if not absolutely, unique. The London *Standard* says of this dinner that the oldest member of the Corporation has no recollection of this hall having ever been lent before for any purpose not immediately connected with Corporation uses, and that the Lord Mayor felt that the occasion was an international one, and as such he was justified in loaning the hall for the entertainment of so important a representative body as the engineers of the United States.

While all American engineers must feel honored in the reception accorded to their absent brothers by England and by France, there is one thing that appears prominent and significant in all this, and that is that the engineer is more appreciated there than in the United States. Should a delegation of foreign engineers honor our shores with a visit, American engineers would welcome them with as hearty a grasp and with as warm hearts as any encountered on the other

side, and our great industries, and every citizen in any way connected with engineering, would unite in this welcome. With our public works, and the magnitude of our resources and our wealth, we could make the occasion memorable beyond a doubt; but there is a step beyond all this in the English reception that we have yet to reach in this comparatively new country. The use of the historic Guildhall in London,—used in the face of long-established custom for a unique purpose,—the presence at the banquet there given of prominent and famous statesmen and others not connected with engineering, and the hearty and complimentary speeches made, all show a *public* appreciation of the profession of engineering to which we have not yet attained.

BUT engineering is young yet in this country, as compared with England; and while our necessities have led us to far surpass in magnitude, quickness of execution, and labor-saving methods employed the practice of our mother country, the men who have done all this are only commencing to receive the general recognition that the influence of their works upon the nation's advance would deserve. It is only within the last decade or two that engineers here have commenced to receive compensation approaching in proportions the services rendered, and there is even now plenty of room for advance in this direction. But it is better now than before; and the reason is that engineers, as a class, are having more respect for themselves and their profession; they are better and more carefully trained; and some studied effort is being made to separate the chaff from the wheat, and to make the so-called engineer prove his title, by entering some association of the craft that rigidly maintains a fixed standard of admission. As a consequence, the corporations and individuals requiring the services of engineers are also commencing to better appreciate the value of their services, either in regular employment or as special experts, and this feeling will grow as the profession of engineering advances itself and its interests by still further intelligent aggregation. It is the Institution of Civil Engineers, more than anything else, that has elevated the engineer in England and has compelled the respect for the name that now certainly exists to a high degree in that country. It was the Institution that obtained the use of the Guildhall for the entertainment of its guests, and at its invitation the great men of England felt honored in being called upon to assist in the welcome extended to these guests. A word to the wise is sufficient. American engineers have also made a very good beginning in founding and building up a society among themselves that should and must some day rank with, if not surpass in numbers, the Institution of England. The influence, however, of the American society upon the profession of engineering and upon the people will depend upon the manner in which the affairs of this society are conducted and its true interests advanced. We have abundant material in hand, and the woods are full of growing timber sufficient to build up the most powerful body of its class in the world; and it will be our own fault if we fail in building up with it the name of the American engineer to proportions somewhat nearer those that his great deeds call for.

THE recovery of the Pennsylvania R. R. Co. from the effects of the floods of May 31 is an illustration of what can be accomplished by energy and organization. It is hardly necessary at this date to recount the extent of the loss to the company in road-beds washed away, bridges destroyed, and stations, etc., that required renewal. It was without doubt the severest blow ever inflicted by the elements upon any American railway corporation. But the executive offices of the company were moved to Broad Street Station in Philadelphia, and from this point material was gathered, men dispatched, and the renewal directed. At the Montgomery bridge over the Susquehanna river, 400 men in four days replaced the four spans washed away. The Granville bridge, 700 ft. long, on the Middle Division, was not only wrecked, but all the piers save one were destroyed; and here a substantial trestling, 720 ft. long and 50 ft. high, was put up in six days. The Mayes bridge, two miles beyond this, was replaced by a trestling 780 ft. long and 50 ft. high in four days. In nine days after the flood that caused the disaster, three large bridges had been re-opened to traffic by rebuilding and seven miles of double-track road had been rebuilt on this division. Between South Fork and the Johnstown bridge, where the waters of the broken dam had spent their force, the famous old Conemaugh viaduct was replaced by a double-track trestlework, 400 ft. long and 78 ft. high, and other bridges rebuilt. In ten days, three miles of the track above Johnstown were entirely relaid, although this portion of the road was exposed to the full fury of the flood and so thoroughly destroyed in places that the most experienced trackmen could not with certainty locate the old road-bed. In twenty days all told 5,000 men put the crippled divisions of the Pennsylvania road once again into full working order, a feat as unparalleled in the amount and character of the work performed as was the flood which caused the original damage. While the cost of all this is to be regretted, as representing just so much wasted treasure, the railroad company is to be congratulated upon the system and energy that enabled them to make good in the time specified the damage done.

The Roll of Great Disasters.

We find that we were, in a sense at least, mistaken in our surmise that the Johnstown disaster was "the greatest in the history of mankind directly due to defects in the devices of man and to nothing else." There is legitimate room for question as to the precise kinds of disasters this definition covers, but interpreting it in a broad sense, there have been several disasters vastly exceeding that of Johnstown in fatality both in Europe and Asia.

The most fatal of all the disasters which can be said to have been due in any sense to "defects in the devices of man," and of which history affords something like a definite record, was probably the terrible inundation in Holland in 1530, when the breaking of one of the remarkable dikes, by means of which that great people has rescued so large a portion of its native land from the sea, overwhelmed several good sized cities and hundreds of villages, causing a loss of life which was of course never definitely determined, but which history now estimates at 400,000. This, indeed, is the heaviest loss of life, from a single cause, of any on record. A previous disaster, of the same nature, in 1446, at Dort, Holland, submerged 72 villages, and is estimated to have cost the lives of 100,000 people. Discounting these estimates liberally, as made in a non-statistical age, these disasters were of fearful magnitude, and are the greatest of which we have definite facts. In comparison with them, even the Johnstown disaster sinks into insignificance. The break-away of the Yellow river in China, however, only two years ago, is stated to have cost the lives of 100,000 people, and there have been a number of previous disasters in China, on that and other rivers, which tradition reports to have been even more fatal

It is more than questionable, however, if these dike disasters fairly belong in the same category as that at Johnstown. If the latter had been caused by some phenomenon like a cloud-burst, entirely beyond provision or effective precaution, or if the failure of the dikes had been caused by construction inferior to that which experience had shown to be essential to safety, there would have been a juster comparison between them. Perhaps the Dutch disasters were so caused in part, for history is not explicit as to the details, but the evidence is rather to the contrary; and in any case, the Dutch were then building immense works, on a scale entirely without precedent, which strained their resources greatly. There was every motive and excuse, therefore, for seeking to make the cost of construction as low as compatible with safety; and this minimum can be learned only through a series of experiments, from which there must often result disastrous consequences, which, in a sense, are pardonable. How much the Dutch have learned from their prior experiments is evident by the fact that no such wholesale disasters have since occurred, although within the last half century alone, or between 1833 and 1877, they increased the area of their country from 8,768 to 12,731 sq. miles, nearly 50 per cent., by the construction of 1,550 miles of sea dikes at a cost of some $62,000,000 (over $24 per acre reclaimed); and these were only the continuation of prior works which had been going on almost continuously since the great disasters mentioned.

The worst subsequent disaster of which we find record was in 1861, when 40,000 acres were submerged by the breaking of dikes, and a good many lives were lost. Practically the whole of Holland depends for its value, if not its existence, on the maintenance of these dikes, for if they were all suddenly to fail, but little of Holland would be left above water, and that little would be mostly a swamp, submerged at very high tides or in very heavy gales. We have an impression that there were a number of minor yet still serious disasters, between 1446 and 1861, which were worse than that of 1861, yet cannot readily find the record of them, and certainly none approached in fatality that of 1446.

Whether or not we grant that the great Dutch inundations belong rather to the class of pardonable disasters, caused by lack of experience, and necessary to gain experience, like many of our early railway disasters, the same charity cannot be extended to any dam disaster. Dams have been built from time immemorial; they are not very enormous structures, in which a trifling decrease of section effects a great economy; they control (ordinarily) bodies of still water only, which no storm can excite to fury, yet which are, at the same time, large enough to constitute a great protection against such phenomena as land-slides or tornadoes. Had the Johnstown disaster been caused by some whirlwind or water-spout, it would have belonged to the same class as the Dutch disasters; but if we interpret the phrase "defects of the devices of man" as meaning avoidable or unnecessary defects only, which was the sense intended, it still remains the greatest of the kind of which we find record.

Earthquakes have been the causes of most great sudden disasters. Among those which are said to have cost the lives of 50,000 or more, was the earthquake in Cilicia, in 1268 (60,000 lives); in Naples, 1626 (70,000 lives, preceded by one in 1456, costing 40,000 lives); Shamaki, 1667 (80,000 lives); Sicily, 1693

(100,000 lives); Yeddo, Japan, 1703 (200,000 lives); Pekin, 1731 (100,000 lives); and lastly, the most famous of all, Lisbon, 1755, costing 50,000 to 65,000 lives, which was followed a few days later by terrific earthquakes in New England, as well as other parts of the world. These latter did little damage at the time, beyond throwing down chimneys and stone walls, but they would, if now repeated, amply suffice to lay our cities of the present day in ruins, with the loss of thousands of lives, if the old records of the disaster are as credible as they appear to be.

The list of earthquakes which have cost the lives of 5,000 people or more, if we go back through the records of all ages and countries, is a very long one, and it would be a difficult if not impossible task to make it complete. So late as 1875, the earthquake of San José de Cucuta, Colombia, cost the lives of about 14,000; and in 1868 an earthquake in Peru and Ecuador killed about 25,000. A still earlier Central American earthquake, in 1797, killed about 40,000. The Charleston earthquake of 1886 cost the lives of only 96 persons, and if a complete list of all earthquakes which were as fatal as this were made, beginning from the Lisbon earthquake only, it would probably fill several columns of this paper. If there is one lesson more than another which the history of earthquakes teaches, it is that, while some portions of the globe are vastly more subject to them than others, and there are restricted areas where serious earthquakes are an almost yearly visitation, no part of the globe is entirely exempt from the danger of severe "quakes;" and that, in all the more civilized countries, they are liable to occur at intervals of a century or two, which in the life of the globe is doubtless a short time. In the life of civilized mankind it is a very long time, so long that it cannot be expected that the plans of architects and engineers, or the general life of the race, can be greatly affected by the possibility. In the case of plans for great structures, like the Quaker Bridge dam, however, which are with reason expected to stand for centuries unless destroyed by some such exceptional cause, and whose failure would involve certain possible unpleasant consequences, while the cost of providing a greater factor of safety against such contingencies is comparatively little, we hold, as we have before stated, that this is a possibility which should not be neglected or lightly spoken of. One fact as to which there may be some dispute seems to us clear and easily demonstrable,—that a very much lighter earthquake than would suffice to demolish well-constructed modern buildings of any class would suffice to destroy a dam built with a factor of safety of only 2 to 2½. There will probably be less disposition to underrate these possibilities than there was before the Johnstown disaster, although the two have no very direct connection; and the attempt to reason from the latter that the Quaker Bridge dam can by any possibility become unsafe, under such ordinary contingencies as caused the failure of the South Fork dam, is entirely absurd.

The worst previous disaster, due to the failure of a dam, of which we find record, was that at Lorca, Spain, in 1802, by which more than 1,000 lives are said to have been lost. Most of the dam disasters seem just now to have been comparatively insignificant affairs, although they seemed serious enough at the time of occurrence. The most destructive one which has occurred before, in this country, was the Mill River, Mass., disaster of 1874, by which nearly 150 lives were lost. The bursting of the Bradfield reservoir, in England, cost 250 lives, and no others so bad are on record, so far as we can discover, among English-speaking people. There have been many small affairs, costing the lives of a dozen or less, but we are unable at this writing to specify any others which have cost so many as 50 lives.

The list of great disasters by inundations, due either to breaking in of the sea or rise of rivers, is a very long one, and we cannot attempt to make it complete in any sense. Besides the Dutch and Chinese disasters which have been mentioned, the coast of England has at various times between A. D. 245 and 1819, suffered from inundations by the sea, which have in some cases cost hundreds of lives, and in one case (A. D. 353, in Cheshire) 5,000 lives, if the old records are correct.

The total number of English disasters of this class is less than a dozen, and the English rivers are too short and too small to have their rise or fall a matter of very great moment; but in countries with larger rivers the list of disastrous river inundations is a very long one, as doubtless the list of future ones will also be, since all arise from the simple fact that every 20, 50, 100, and 250 years or so, there is sure to be so heavy a flood that men will have forgotten to consider it among the possibilities, and act accordingly. Thus at Lyons, in 1840, the Saone rose to a greater height than had been known for 238 years (there happened to be records to fix this fact), with the result that Lyons was inundated and many houses from the cities and towns carried away, with loss of many lives. In 1856 the south of France suffered from other severe floods, but nothing like those of 1840, for a parallel to which, very likely, we shall have to wait for another 238 years, until A. D. 2,078. Possibly it may be 500 years, however, possibly not 5; for experience has clearly shown that the fact that some exceptional flood has just occurred is no evidence—not even presumptive evidence—that a still greater one may not follow close upon it; although it is as difficult for average humanity to realize this fact as it is to realize that if "heads" has turned up a dozen or a hundred times in succession in tossing a coin, it is still an even chance that it will be "heads" again next time.

In comparison with any one of the long list of fearful disasters due to water and earthquakes, the most of the railway disasters seem small affairs. Almost the very worst on record is the Armagh disaster of this very month, which, had it not followed so close upon the Johnstown disaster, would have attracted great attention, and justly, since it seems to have been due to an extremely loose and imperfect system of operation, not to say also of constructing cars. In that disaster 75 lives were lost, and 80 to 90 injured. There are but three worse ones than this on record, which were the Morelos bridge failure, in Mexico, by which 200 soldiers lost their lives; the Richelieu river, open-draw disaster of 1864, on the Grand Trunk, by which 86 lives were lost and 400 injured; the Ashtabula bridge disaster of Dec. 29, 1876, in which 80 to 100 lives were lost and 60 injured; and the Chatsworth, Ill., wooden culvert disaster of Aug. 10, 1887, in which about 77 lives were lost. If we descend to accidents costing 30 or 40 lives, the list becomes very much longer, and of course more instructive to examine. Of great disasters, in the broader sense, there are none in railway annals; but this immunity is more than made up by an incessant string of minor disasters, causing the death or injury of 2 to 20, which makes the aggregate annual fatality from railways 1,200 to 1,500 per annum from train accidents in this country alone, with an unknown but very much larger aggregate from accidents in coupling and crossing or other accidents to employés and others apart from train accidents. Not without reason, therefore, does the question of safety by rail attract the greater proportion of public attention.

Bureau Control of Public Works.

We are glad to note that Secretary of the Navy Tracy has taken a most decided step forward in the direction of much needed reorganization in his department. By the slow process of time and radical changes in condition, the bureau control of this department had become so complex that it amounted to no control at all, and, as a result, there was a constant loss of time, material, and effort in conducting its business. Ex-Secretary CHANDLER attempted reform, but was met by old-fogy influence in the Navy itself too powerful to combat; and while ex-Secretary WHITNEY fully realized the necessity for reorganization, it was left to the present incumbent to make the change. The replacement of wooden ships and old armament with new ships and modern guns, the actual rebuilding of our entire navy, was properly regarded as the auspicious time for remodeling the department system that was to control in this new order of things. By the very reason of this change in the Navy, the old confusion was being worse confounded; new demands were constantly arising, and new equipments and new duties were being scattered about among the several bureaus as the convenience of the moment might suggest. As an example, the control of electric lighting was claimed by three bureaus; the training of officers and men, apart from the Naval Academy, was divided, and there was no officer to control the personnel as a whole.

Secretary TRACY was wiser than his predecessors in only taking counsel with two or three old and trained officers of high rank in the Navy, instead of asking the advice of the bureau officers themselves,—advice which heretofore has simply clogged the wheels of reform. He took the wiser because the surer course of simply issuing an order which all the bureaus must obey without question: he can remodel his instructions as time may test their working. Under the new order, the Bureau of Navigation loses its duty of supply and its control over other important offices, and becomes, under the immediate direction of the Secretary, an executive section for military matters, charged with the discipline, training, and control of the personnel of the fleet. The Bureau of Equipments has the control of nearly all the supplies lost by the Bureau of Navigation, and also has in charge the hydrographic and compass offices and the naval observatory. The bureaus for constructing, manufacturing, and purchasing have assigned to them duties systematically and appropriately grouped, and in all cases the limits of authority are well defined. Finally, the chiefs of the Bureaus of Yards and Docks, Equipment, Ordnance, Construction and Repair, and Steam Engineering constitute a board for the design, construction, and equipment of the new ships. Generally, the department is at once put upon an orderly basis that must put an effectual stop to past complexity of control and conflict of authority.

The work thus accomplished by Secretary TRACY in systematizing the methods of his department leads us to hope that reform will not end with the Navy. Other departments of our Government have almost to an equal degree found themselves trammeled by a division of authority, brought about by a similar change in conditions, and by methods inherited from past generations of officials. The work of the

engineer, for example, is now divided under the Army, the Navy, the Treasury, and the Interior Departments, though much of it would be better and more economically done under one control, because, divided as it now is, the same work practically is often repeated unnecessarily. One properly organized and officered department that can survey the whole field of action is much better able to judge of the effect and value of any one operation than an independent bureau charged only with the execution of this one piece of work. And this is especially true of the design and execution of our public works and of our national surveys. Good work is being done in all directions, and we have able men in immediate control of most of these public undertakings now under way, even under the manifest disadvantages of the present system. But because this is so, better and more work could also be done under more systematic control, and the able men now in the service could rise to still higher rank in professional eminence than is at present possible. The Navy was notoriously under the control of barnacle-laden, antiquated methods, and it was but a short time ago deemed an almost hopeless task to attempt a radical reform. But Secretary TRACY has knocked off the barnacles by one firm, well-digested order, and similar good results should follow well-considered action in other departments, or the Cabinet as a whole, if as earnestly and firmly pushed.

In connection with this question of engineering, Secretary TRACY has yet one reform to make in his Bureau of Yards and Docks. There is no objection to putting this bureau under the authority of a naval officer, and, in fact, it should be only so officered; but the actual work of designing and building docks, and the multitude of other distinctly engineering work that naturally falls into this bureau, should not be subject to the arbitrary veto of an official who professionally knows nothing at all about them. Such work belongs to the trained civil engineer, and the Navy Department has partially recognized this fact by employing a corps of such engineers in its service. If the department has sufficient faith in the engineer to confide to him the design and actual execution of its docks, etc., it should go a step further, and vest the final acceptance or rejection of proposed plans in a board of engineers selected from the best in its service. Let this board consult with the Commodore at the head of the Bureau of Yards and Docks, if you please; but the civil engineer should finally decide upon engineering plans. The approval of such plans by the naval head of the bureau is now practically a matter of mere form; but he has the power to amend or veto absolutely, and while little or no good can arise from the exercise of this power, there might be times when it would do mischief. Other countries put the control of all similar work in the hands of engineers, where it properly belongs, and our Government should do the same thing.

The American Engineers Abroad.

We have received the following further "notes of travel" from our special correspondent, Prof. L. M. HAUPT, now with the American engineers in Europe:—

The several organizations of American engineers turned out on June 13 *en masse*, and with their lady friends attended the choral service at 10 A. M. at Westminster Abbey, followed by a very interesting salutatory and historical address in Henry VII's chapel, from the Very Rev. Dr. BRADLEY, the Dean. After a hurried inspection of the relics of the kings, martyrs, statesmen, scholars, engineers, soldiers, etc., with which the Abbey teems, the party proceeded to the Parliament houses and the embankment terrace.

Up to this writing about 170 engineers have reported at the rooms of the Institution of Civil Engineers, which have been placed at our disposal through the courtesy of our English brethren in the profession.

The dinner given by the Institution of Civil Engineers at the Guildhall was a grand and successful affair. Mr. ROBERT LINCOLN, American Minister, made his first appearance before the English public, in an appropriate and telling speech. He was very warmly received.

Possibly the one industry which impresses us most forcibly is the extent of the ship building. The story of the Clyde is old, but it is not the only instance of the kind here, for we find all the harbors crowded with commerce. At Belfast the stocks are full of ocean steamships of the largest class (the *Thingvalla* was almost ready for her trial trip). The Clyde from Greenock to Glasgow, the Tyne from Newcastle to Tynemouth, 32 miles, including both banks, the Thames and many other rivers are lined with new ships in various stages of construction. One naturally wonders where they are to find cargoes, and can readily understand why the British flag is found in every quarter of the globe, and why London is the commercial metropolis of the world.

The location of the island and the great range of the tide conspire to produce this effect, but her engineers have greatly assisted by extensive dock and harbor works which are unprecedented. These works have become possible by a system of adminstration which authorizes local port boards to levy a limited toll on the tonnage of all vessels, which revenue is expended on the improvement of the harbor. This system is found to work admirably, as the commission select their own engineer, who is permanently employed to carry out the works. Hence it is that England is so abundantly provided with commercial facilities and a small river is soon converted into a channel of great importance. It would not be in order to describe here in detail the very interesting and successful harbor works we have visited, but we feel that their importance cannot be overstated and that our country needs more and better facilities in this direction, which we think will be most readily secured by a change in our method of adminstration to a civil rather than a military policy.

The Institution of Civil Engineers, under the efficient management of Sir JOHN COODE, President, JAMES FORREST, Secretary, and an able committee of over 200 members have been entertaining us so regally as to leave little time for writing, and the Paris program is quite as full of promise. There are a few things, however, which impressed us forcibly as being advances over anything to be found at home, and these we note.

Cable Traction.—The conduit is much simpler and less expensive, yet it appears to fulfil all the requirements. In Edinburgh three miles are in operation and an extension is now under construction. The yokes are rectangular frames of cast iron about two (2) feet square resting upon a concrete bed. They are placed about four (4) feet apart and the conduit is made of concrete. The grades of this line are in some cases 1 in 11. Great advances have been made in the cable whereby its life is increased from 50 to 100 per cent. This is a startling claim, but it appears to be abundantly justified by experience and is sustained by numerous certificates, testimonials, and samples cut from lines where this cable has been in use. Where the old cables lasted three months, these will run six under the same conditions. The difference is due to the method of twisting the strands so as to produce a strain across the wire instead of with it. In the latter case, as soon as the wires wear partially through, the grip causes them to buckle from compression and break, while in the former they are ground down almost to a knife edge and become embedded under adjacent threads, leaving a smooth surface.

Seventeen thousand feet of 1¼ in. cable will weigh 15 tons. Under this patent the rope and the strands are laid in the same direction. There is thus a much larger surface exposed to friction, and the cause of wires breaking upon the crown of the strand is removed. The working of the rope around drums, pulleys, and curves bends the wires obliquely, and thus the greatest amount of wear is secured.

Since the introduction of the rope in 1880 it has been applied at many of the largest colliery and mining works in this country. It is made of a hard Bessemer wire having a tensile stress of 125 tons per sq. inch.

The City of London & Southwark subway is an interesting piece of subterranean tunnelling. It was the privilege of Mr. THOS. C. CLARKE and the writer to be conducted through the works by the engineer, Mr. J. H. GREATHEAD, from the shaft at Kennington Oval to the shield 2,000 feet distant at the heading. Space does not permit of a minute description, for which see *The Engineer*, London, June 7. It will suffice to say that it is an iron shell of sections with internal flanges 10½ ft. in diameter inside, and that it is being pushed by means of a pilot at the rate of 12 ft. per 24 hours through the dense clay. Occasionally water bearing strata are encountered, when the progress is about one half. In this case compressed air is used. The line is nearly completed; it is proposed to operate by electricity.

PERSONAL.

Mr. S. W. CHAMPION has been appointed Superintendent of the Green Bay, Winona & St. Paul Ry.

Mr. L. S. ANDERSON has been chosen Assistant Secretary of the Union Pacific Railroad Co.

Mr. ROBERT BLEE has been appointed General Manager of the Cleveland, Columbus, Cincinnati & Indianapolis Ry., vice Mr. BEACH, resigned.

Mr. E. T. TURNER, C. E., has been appointed Director of the New York State Meteorological Bureau and Weather Station at Ithaca.

Mr. A. W. QUACKENBUSH has been appointed Superintendent of Machinery of the Chicago & Alton Ry., vice Mr. WILLIAM WILSON, resigned.

Mr. W. WORTHINGTON, General Superintendent of the Fort Wayne, Cincinnati & Louisville, has resigned.

Mr. C. C. WAITE, Vice-President and General Manager of the Cincinnati, Hamilton & Dayton, has resigned.

Mr. M. W. MACGUIRE, Trainmaster of the Baltimore & Ohio, has accepted a position on the New York, Lake Erie & Western, with office at Susquehanna, Pa.

Mr. MICHAEL CUNNIFF, of Ware, Mass., Roadmaster of the Central Massachusetts Ry., died recently at Boston.

Messrs. GARDNER G. MERCER, JACOB C. KENYON, JAMES E. CONNELL, CHARLES B. BALDWIN, RUMONT KRATZER, ERWIN FAIRBANKS, and CHARLES N. BLISS, have been appointed Water Commissioners at Baldwinsville, N. Y.

Mr. M. A. HANNA, of Cleveland, O., formerly a Government Director of the Union Pacific, has been elected a director of the company, vice Mr. ANDREW H. GREEN, of New York, resigned.

Mr. J. T. HARRAHAN, General Manager of the Chesapeake & Ohio, with headquarters at Cincinnati, has been appointed Traffic Manager of the road. He was formerly General Manager of the Louisville & Nashville.

Messrs. J. B. BROOKS, WM. H. WARNER, CHAS. HUBBARD, WM. K. NIVER, P. B. MCLENNAN, and H. J. MOWRY have been appointed Water Commissioners by Mayor KIBE, of Syracuse, N. Y.

Mr. GEORGE HACKNEY, Superintendent of Machinery of the Santa Fé system, has resigned, and will be succeeded by Mr. HARVEY MIDDLETON, now of the Louisville & Nashville.

Mr. H. R. WHEELER, late on the engineering staff of the new Croton Aqueduct, has been appointed engineer in charge of the tunnel and "zig-zag" improvement on the Ontario & Western R. R., with headquarters at Walton, N. Y.

Mr. GEO. NORWOOD, railway contractor, working on the Knoxville, Cumberland Gap & Gloversville Ry., was shot and killed by an Italian laborer at Cumberland Gap, Tenn., June 23.

Mr. THOS. D. KLINE, Superintendent of the Northern Division of the Mexican National Railway, has been appointed General Superintendent of the system. His headquarters will be at Laredo.

Mr. W. J. MCKEE, Chief Train Dispatcher of the Chesapeake & Ohio, has been appointed Acting Superintendent of the Cincinnati division of the C. & O., vice Mr. I. G. RAWN, promoted.

Mr. I. G. RAWN has been appointed Superintendent of Transportation of the Chesapeake & Ohio R. R., with headquarters at Cincinnati, vice Mr. J. W. SHERWOOD, resigned.

Mr. W. S. MARTIN, Master of Transportation of the Louisville, Evansville & St. Louis road, has resigned, to accept the position of Superintendent of the Birmingham and Decatur divisions of the Louisville & Nashville road.

Mr. W. R. THORNELL, of Seattle, W. T., Manager of the Seattle, Lake Shore & Eastern Ry., has been granted leave of absence, and Mr. F. W. D. HOLBROOK, Principal Assistant Engineer, will take his place.

Mr. GEORGE W. SAUL, the new General Manager of the Fort Wayne, Cincinnati & Louisville and the Whitewater Valley roads, has for 5 years been the private secretary of Mr. C. C. WAITE, General Manager of the Cincinnati, Hamilton & Dayton Lines.

Messrs. A. MACKAY, C. L. COLE, C. S. WRIGHT and C. S. CRANE have been elected additional members of the Central Traffic Association Committee to confer with the trunk lines for the purpose of establishing a uniform basis of division of through rates. The Committee as at present constituted is as follows: D. T. MCCABE, Chairman; H. D. GOULD, G. B. SPRIGGS, G. J. GRAMMER, R. M. FRASER, ALEXANDER MACKAY, C. L. COLE, C. S. WRIGHT, and C. S. CRANE.

Mr. ANDREW ONDERDONK has resigned his position as First Assistant to the Resident Engineer of the Baltimore & Ohio R. R., stationed at Camden Station, to accept the position of Chief Engineer of the Roanoke & Southern R. R., with headquarters at Winston, N. C.

Capt. WM. PIERCE, Superintendent of Public Works of New Orleans, La., committed suicide by shooting on July 1. No reason is assigned.

Prof. GOULD, of Harvard, is prominently mentioned for the vacant position of Superintendent of the Coast Survey. The salary is $6,000 per annum.

The address of —— BILLINGS, an engineer who served in Newfoundland four years ago, is wanted at once at this office.

Mr. D. C. DUNLAP, C. E., late of Chicago, Ill., has been appointed City Engineer of Rockford, Ill.

Mr. EDWARD STAYMAN, a civil engineer, died on July 2 in Sioux City from heart disease. Mr. STAYMAN was from Carlisle, Pa., and was employed in the construction of the New Croton Aqueduct and lately in Sioux City. He was about 26 years of age.

Prof. GEORGE DAVIDSON, of the U. S. Coast and Geodetic Survey, has had the honorary degree of Doctor of Sciences conferred upon him by the University of Pennsylvania. Prof. DAVIDSON was graduated from the Philadelphia High School and was placed in the Coast Survey by Prof. BACHE in 1845, and since then he has served without a single leave of absence.

Mr. A. A. ALLEN has resigned as General Superintendent of the Wisconsin Central, and has been appointed General Manager of the Chicago & Great Western, with headquarters at Chicago. The latter is controlled by the Wisconsin Central, and gives it an entrance into Chicago, owning valuable terminal facilities in that city. Mr. ALLEN has been with the Wisconsin Central since 1882 in the positions of division superintendent, assistant general manager, and general superintendent.

Mr. GAVIN CAMPBELL, General Manager of the Green Bay, Winona & St. Paul road, has been appointed General Superintendent of the Wisconsin Central, succeeding Mr. A. A. ALLEN. Mr. CAMPBELL was formerly connected with the Wisconsin Central, 4 years as master mechanic and 7 years as division superintendent. He went to the Green Bay, Winona & St. Paul in 1885.

THEODORE DWIGHT WOOLSEY, D. D., L. L. D., died at New Haven, on July 2, aged 88 years. Mr. WOOLSEY was born in New York, Oct. 31, 1801; graduated at Yale in 1820; studied law for one year in Philadelphia, and theology two years at Princeton; was a tutor at Yale for two years and was licensed to preach in 1825. From 1831 to 1846 he was professor of Greek and literature at Yale and in the latter year was appointed President of the college, a position he retained until 1871, when he retired for much needed rest.

MARIA MITCHELL, famed as an astronomer and teacher, died at Lynn, Mass., on June 28. Miss MITCHELL was born on the island of Nantucket, Aug. 1, 1818, the daughter of WILLIAM MITCHELL, likewise an astronomer and teacher. She studied under her father and under CHARLES PIERCE, and later became an assistant to the latter in the Nantucket school. When 17 years of age she was made librarian of the Nantucket Athenæum and devoted all her spare time to astronomy. On Oct. 1, 1847, she discovered her first comet, and received a gold medal from the King of Denmark in recognition of her discovery. She was for a time employed by the Coast Survey at Nantucket on the Nautical Almanac. She was next appointed professor of astronomy at Vassar College, a post which she held until last year. Miss MITCHELL was in 1858 the honored guest of Sir JOHN HERSCHEL, Sir GEORGE B. AIRY, LEVERRIER and HUMBOLDT. She was the first woman elected to membership in the American Academy of Arts and Sciences, and was afterwards a member of numerous other societies. In 1852, Dartmouth College conferred upon her the degree of LL.D., and in 1887 Columbia College honored her with the same degree. She published numerous scientific works.

PUBLICATIONS RECEIVED.

Catalogue of Steam Specialties, Standard Scales, etc.—Fairbanks & Co., 311 Broadway, N. Y. Cloth, 12½ x 9 ins. 114 p. p., 30 p. p. of advertisements.

This is another specimen of the modern style of trade catalogues; a well arranged and printed book, of good paper, profusely illustrated and neatly bound in cloth. Illustrations and lists of prices are given. Among the specialties are valves and cocks of various kinds, water gauges, steam traps, the Hancock inspirator, vulcabeston, trucks, portable forges, jacks, copying presses and scales of different kinds. The lists of prices make the catalogue useful for reference, and the book will probably be placed in the "trade library" of those who receive it.

Description of the Water-Works at Richmond, Va.—By C. E. BOLLING, Superintendent. Pamphlet, 8 pp.

This is a comprehensive history of the water-works from 1832 to 1889, containing photographs of the pumphouses, one of the water-wheels, one set of pumps and a partial view of the reservoir.

—*Geological Survey of New Jersey.* Annual Report of State Geologist for 1888.

Mr. GEORGE H. COOK, State Geologist, here reports that the topographic and magnetic surveys were completed in 1887 and the first volume of the final report is published and is being distributed. The work now preparing for publication is the second volume of the final report. This will contain a full catalogue of minerals found in the State and their localities; a catalogue of all plants and also of the vertebrate and invertebrate animals in the State. Most of the work in this connection is completed. The report itself contains notes on: "The Triassic or Red Stone Rocks," "Drainage of the Great Meadow in the Pequest Valley, and of the Lowlands on the Passaic, above Little Falls," "Water Supply and Artesian Wells;" "Statistics of Iron-Ores, Zinc-Ores, Fire-Clays, Stoneware Clays and Brick."

CORRESPONDENCE.

Another Earth Dam.

NEW YORK, June 18, 1889.

TO THE EDITOR OF ENGINEERING NEWS:

You omit from your list of earth dams that of the Receiving Reservoir of the Washington Aqueduct, about 60 ft. high, across the valley of Falls Branch. By the original plans the top of this bank was to be 7 ft. above water surface, with a waste weir 50 ft. long. The watershed about 4,000 acres. In August, 1856, when the base had been prepared, and the puddle trench excavated to the rock, but very little embankment made, a rainfall occurred varying from 5½ ins. in 24 hours at Washington to 6⅛ ins. at Great Falls, the greater part falling in about 3 hours. The resulting flood in the stream, as computed from the water marks by the Prony formula, indicated a flow of over 5,000 cu. ft. per second. This was probably excessive. A further computation showed that this quantity of water flowing into the reservoir, the surface of which was about 60 acres, while flowing out over a waste 50 ft. long, would in 3 hours raise the reservoir surface 10 ft. In consequence, the waste was made 100 ft. long and the embankment was raised to 15 ft. above normal water surface. Some years later, water surface was raised 5 ft. by a timber dam across the rock cut, serving as a waste.

The embankment was designed with a top width of 20 ft. and slopes of 2 and 3 to 1, on the outside and inside respectively. A large part of the surplus material from the cut was used to widen the bank to nearly 50 ft. on top if I remember, and to riprap heavily the inner slope. The bank was made with a puddle wall in the centre, puddle wet and cut and worked as described by Mr. MCALPINE for the Cuba dam in your last. On each side of this a certain thickness of good clay carted in layers, and the outside of heavy material. No core wall was used, or even a "tooth" wall, which is sometimes a good thing to prevent filtration under the puddle over a very smooth rock. H.

[Our list was somewhat hastily compiled from data in this office, and doubtless others were omitted. But we are indebted to our correspondent for the further interesting information here given.—ED. ENG. NEWS.]

Centre-Walls in Earthen Dams.

SCRANTON, PA., July 1, 1889.

TO THE EDITOR OF ENGINEERING NEWS:—

Permit me to correct an error in the notice you kindly give of my "Specifications for Dams and Reservoirs," which appeared in your issue of 29th ultimo.

The notice says: "The class of dam directly contemplated by the specifications is of the very generally used type (the dam which has just failed was of this type) which consists of a masonry centre-wall and spillway, and an earthen embankment," etc. The error is contained in the parentheses. The Johnstown dam was built without a centre-wall, and, therefore, differed organically from the type in question. In the connection in which it occurs, this inaccuracy is of small importance, and would not call for a correction; but I avail myself of the opportunity which it offers to give a timely emphasis to the necessity of this grand feature of the earthen dam.

Mr. McAlpine, in his noteworthy communication in the same issue, assigns three principal causes for failure of earthen dams. The first, to which he charges two-thirds of the total number having come under his examination, is leakage from outlet pipes or conduits; the second, an incomplete connection between the natural and artificial banks, admitting the passage of a film of water between the two; and the third, the overtopping of the bank occasioned by an insufficient spillway.

Of these, the first two may be entirely eliminated by a good masonry centre-wall, and the effects of the third would be very favorably modified, if not wholly annulled, by the presence of such a wall.

I do not question that an earthen dam, pure and simple, may be built so as to be perfectly tight and safe, but the addition of a well-proportioned centre-wall of hydraulic masonry, carried to a proper depth, and penetrating well into the sides of the valley, raises the type of structure at once to a higher and more perfect one. I think the singularly minute precautions insisted upon by competent authorities as essential to insure a dam formed wholly of earth against destruction, are, of themselves, sufficient evidence that such dams are, in their nature and essence, weak and treacherous, and not to be recommended. While it is true that all work connected with dams and reservoirs should be executed in every particular with scrupulous care, it is a still more fundamental truth that the anatomy of the structure should afford a wide margin of safety against any minor faults of execution, and that a collapse should never be liable to result from the occurrence of a few yards of imperfect work.

E. SHERMAN GOULD.

Notes and Queries.

CLAY PUDDLERS.—By an oversight in not affixing initials to a query in our last issue, asking for the address of parties manufacturing clay puddlers, the original letter is practically inaccessible, filed away in a mass of correspondence. We now have answers to our query and want the original correspondent. For the benefit of engineers generally we will say, however, that clay-puddle mills are built for the general market by Mr. ALBERT E. JENKINS, Mechanical and Constructing Engineer, of Scranton, Pa., and if our correspondent will address him he will doubtless find what he wants.

SOCIETY PROCEEDINGS.

American Society of Civil Engineers. ANNUAL CONVENTION. (*Continued from June 29, page 603.*)—On Monday, June 24, the business meeting of the Society was held. The final report of the committee on "The Proper Relation to Each Other of the Sections of Railway Wheels and Rails," was presented, and there was a lengthy discussion as to whether the committee should be continued and directed to carry out the work of preparing standard rail sections, or whether it should be discharged and a new committee subsequently appointed. It was finally decided that the report be received and the committee discharged, with the thanks of the Society for the valuable work which it has done, and that a new committee should be appointed by the Board of Direction to devise standard rail sections. This new committee will probably include most of the members of the old committee. In the discussion on this matter, Mr. SHINN stated that the Cambria Iron Co. has 33 sections, 10 of which are for 60-lb. rails, and 18 between 56 and 63; the Pennsylvania Steel Co. has 24 sections; the Edgar-Thomson Co. has 32, of which 4 are for 60-lb. rails, 6 for 56, and 10 between 56 and 63 lbs. He himself has recently designed a new section. He also approves of standard drilling.

A communication was read from Mr. SANDFORD FLEMING, Chairman of the Committee on Uniform Standard Time, making suggestions in regard to the action to be taken in extending the use of the standard time system. It was resolved that the Board of Direction should send out not exceeding 2,000 copies of the committee's report and proposed circular, this number being in addition to the copies for the members, and being sent out at the Society's expense.

Mr. C. B. BRUSH presented a resolution, which was adopted, for the appointment by the President of a committee of three members to consider the troubles experienced in regard to the purity of water supplies; the committee to report at the next annual meeting on the steps which should be taken by the Society in connection with this matter. The importance of this subject, and the very general interest taken in it, has been shown by Mr. RAFTER'S paper and the extended discussion which followed it. With the increase of population, the growth of cities and towns, and the extension of sewerage systems discharging into water courses or lakes, etc., the question of obtaining a pure water supply, or of purifying an existing supply, becomes of increasing importance, and, as suggested by Mr. FTELEY, during the discussion on Mr. RAFTER'S paper (when Mr. BRUSH stated his intention of presenting this resolution), the Society ought to take the lead in investigating this matter.

In regard to amendments to the constitution of the

Society, Mr. SHINN presented a resolution to the effect that a committee of 7 members be appointed by the President to consider and report upon amendments to the constitution and by-laws; if it recommends any amendments, it is to present them to the Board of Direction as provided by the by-laws, and the report of the committee, together with the proposed amendments, is to be submitted to the members. Any suggestions which may be made by members will be considered, and the committee is to make its final report at the next annual meeting. Mr. SHINN, in presenting this resolution, referred to the fact that the constitution had been amended from time to time until its present arrangement and provisions were unsatisfactory; several suggestions for its thorough revision have from time to time been made, and he thought it would be well to undertake a thorough study of the matter without further delay. He stated also that the formation of local engineering societies had tended to weaken the main society by lessening the number of papers presented, as the authors naturally prefer to read their papers themselves before a number of acquaintances and friends, rather than to read them or send them to be read before a body of comparative strangers. In connection with the action recently taken by the Cincinnati members in preparing a series of suggested amendments (see ENGINEERING NEWS, June 22, 1889, p. 566), the new committee to be appointed under this resolution will confer with committees from local societies. Allusion was made to a possible future affiliation of the local societies with the main Society.

A letter by Mr. A. M. WELLINGTON was read, approving of the appointment of such a committee; the arguments were substantially the same as those in the editorial in ENGINEERING NEWS, June 22, p. 575.

At the instance of Mr. COHEN a resolution was passed expressing the gratification of the Society at the formation by the Smithsonian Institute, in connection with the U. S. National Museum, of a department for the collection of models, drawings, and data relating to the history and growth of American engineering, and recommending that all American engineers should cooperate with this department in furthering its objects.

Mr. SEAMAN introduced a resolution for the appointment of a committee of 7 members, by the Board of Direction, to devise and report upon uniform specifications for the material and workmanship of iron and steel railway bridges. This caused a good deal of discussion as to the desirability of standard specifications for such work, the general impression seeming to be in opposition to such specifications, and ultimately the resolution was withdrawn. At the afternoon session, however, Mr. DAGRON presented a resolution for the appointment of a committee of 7, to be appointed by the President, to consider and report upon the uniform testing of material for metallic structures, and also to report upon requirements for improving the grade of such structures. On vote, the meeting recommended the adoption by the Board of Direction of the first part of the resolution, but in the vote on the second part there were 19 opposed to such recommendation, 2 in favor, and 13 non-voting; the latter not approving of the methods of procedure in regard to resolutions.

At the afternoon session the following members were elected to form the Nominating Committee, the districts represented being the same as last year:

New York City and 50 miles around, STEPHENSON TOWLE.

New England, rest of New York, and Canada, Major MICHAELIS.

Pennsylvania and South Atlantic States, F. H. SMITH.

States South of the Ohio river, including Missouri, Kansas and Colorado and the Pacific slope, ARTHUR MACY.

States North of the Ohio river, and the Northwest, J. F. WALLACE.

After the adjournment of the meeting in the afternoon a number of the party went to see the Hyatt filter plant and aerating process in operation at the Long Branch water-works. In the evening the annual banquet was held, at which about 100 persons were present; the arrangements were well carried out and it was a pleasant social occasion, although in the way of speeches it was hardly a success, the Society not being rich in fluent after-dinner speakers.

On Tuesday, June 25, Mr. FRANCIS read a brief paper on the effect of a rush of water in streams on the streams below, showing that the volume of water in the large streams overtakes the smaller ones and goes on as one mass, the front of the wall of water being practically vertical. Prof. MERRIMAN stated that the observations in western cañons confirmed this view.

The report of the committee on "The Proper Relation to Each Other of Railway Wheels and Rails" was read, but was not followed by any discussion. An abstract of Mr. WHITTEMORE'S paper on "Cylindrical Wheels and Flat Topped Rails" was read, with abstracts of written discussions. The discussion by Mr. BECKER drew conclusions that Mr. WHITTEMORE'S figures in regard to the scrap heap were too high; Mr. BECKER thought that the amount for rails, at 15 years life of rail, would be about 2,000,000 tons, or say a loss of $12,000,000 per year; and a loss of say $3,000,000 per year for wheels. Mr. C. P. SANDBERG'S discussion stated that in rolling flat top rails there are more wasters, and that the flat top is more porous. Mr. WHITTEMORE'S paper, with remarks thereon, was published in ENGINEERING NEWS, Feb. 9, and several succeeding issues; also May 11.

A short paper by Mr. PERCIVAL ROBERTS on "Punched and Reamed Steel" was read by the Secretary; it referred to a series of six pairs of specimens cut from 6x6-in. angles and torn apart in the testing machine; one plate of each pair had punched holes and the other punched and reamed holes. The results were as follows, showing the advantages of reaming:

	Punched.	Punched and Reamed.
1st pair,	85,000	125,000
2d "	99,000	129,500
3d "	86,000	134,000
4th "	83,500	122,800
5th "	102,300	134,000
6th "	106,000	133,000

There was some discussion over the merits of the drifting test (See ENGINEERING NEWS, April 27, May 18, 25 and June 1), Mr. SEAMAN and Mr. DAGRON agreeing that it was not of as much service as has been claimed. Mr. SEAMAN did not think it would show defects that the bending test would not show.

A photograph of a lattice girder bridge, with two spans of 200 ft., was exhibited by Mr. GEO. H. THOMSON, in connection with his remarks on June 21 in discussing Mr. COOPER'S statements as to the use of lattice bridges in this country (as noted in our report last week).

A communication from Prof. LANDRETH, on the subject of "Highway Improvement," pointing out the defects of the present methods and the needs of a systematic and scientific method of construction and maintenance, was read and briefly discussed. Mr. BECKER referred to the action being started in Pennsylvania. Mr. TALBOT stated that in parts of Illinois advantage is sometimes taken of an optional law allowing the commissioners to control the roads, the taxes being paid direct; under this system the roads are built and maintained by experienced men instead of by farmers. Mr. LANDRETH'S paper on "The Influence of Temperature during Setting, on Strength of Cement Mortars, and Influence of Repeated Mixings, before Setting, on Strength of Cement Mortar," was read by the Secretary. It gave the results of a number of experiments made with different brands of cements.

The first paper read at the afternoon session was one on "The Improvement of Railway and Street Railway Track," by Mr. R. E. RUSSELL TRATMAN. It commenced by pointing out the importance of the subject, and showing that, while improvements are gradually being made, yet the rate of progress is far behind that of the improvement of the rolling stock. Attention was called to the excellent construction and elaborate fitting of passenger cars, and to the fact that some of these fine heavy cars are run over 50-lb. rails in the South. An 80 lb. rail was recommended as the minimum for trunk lines, and in connection with the committee's report favoring a shallow head, it was suggested that such a head might be too weak when it had been worn down. Reference was made to the European practice of sprinkling gravel over stone ballast. Tie-plates of different kinds were described and the advantages of steel ties pointed out. Some improved forms of spikes were described, but screw or bolt fastenings were said to be the only apparent means of giving a positive hold on the rail. Tie rods at curves would hold the rails to gauge and prevent spreading. As to joints, the rail joint is to the track what the car coupler is to the rolling stock, but while a large number of joints have been designed, and to some extent adopted, the angle-bar joint, 24 to 48 ins. long, with 4 or 6 bolts, and sometimes with a tie under the joint, is the type most generally used. Various joints were described, including the WRENSHALL joint, which consists of a 12-in. piece of rail, put between adjacent rail ends to take the pounding of the wheels; reference was also made to a 5-bolt joint, the middle bolt holding the rail ends in line. The need of improved frogs to avoid the cutting of the main track rails at every side track, was pointed out, and also the necessity for the more extended use of safety switches, signals, and interlocking systems; the recent introduction of electricity in connection with signals was also alluded to. In regard to bridge floors, Mr. TRATMAN considered the solid floor and continuous roadbed, as now being introduced by Mr. GEO. H. THOMSON, Bridge Engineer of the New York Central Ry., to be by far the best plan, as the ballast acts as a cushion to absorb the destructive vibration set up by passing trains, and is thus beneficial to the bridge and the rolling stock. Systematic systems of track accounts and records are of great value, and the system introduced on the Louisville & Nashville Ry. by Mr. ALBERT FINK was instanced. In referring to street railway track, the advantages of a good metal and concrete track were pointed out, but it was shown that these advantages would not be obtained on the average city street, which has no firm foundation, and the pavement of which is allowed to wear into ruts and low places. With a good street foundation and pavement and a good system of track, the trouble with grooved rails would probably be found to have been overestimated. Various forms of improved tracks were described. The paper was illustrated with a number of drawings, and we shall publish it in full very soon.

In the discussion which followed, Mr. VOORHEES stated that the Davies spike had been in use for about a year, as an experiment, on the New York Central Ry., and had so far given good results. Some fastening better than the ordinary spike was certainly needed. He did not think electricity reliable as yet for signaling operations. In regard to the recommendation for the use of tie rods at curves, Mr. FLAGG and Mr. BRYSON stated that they had seen them used, the former in South America and the latter in this country. Mr. VOORHEES thought tie rods, holding the rail at the bottom, would not be as efficient as rail braces. As to gravel "boxing" on stone ballast, Mr. MENDEZ COHEN stated that in the construction of the B. & O. extension west of Cumberland, large stones, broken to a 5-in. ring, were used for the lower bed, with 6 or 8 ins. of sand or gravel on top. The result was that the upper part disappeared, but eventually a very good track was obtained.

A short paper by Mr. E. E. RUSSELL TRATMAN, on "Metal Track for Railways," was then read. It was an abstract of a report made to the U. S. Department of Agriculture in February, and its main purpose was to show the great extent to which such track, in various forms, is in use on railways in foreign countries, showing conclusively that the metal track question has got beyond the experimental stage. It also referred to experiments made in America. An extract from this report was published last week (June 29, p. 589), and we shall probably give it more extended notice at a later date. A paper on "The Settling and Filtration Basins of the Vicksburg Waterworks," by Mr. CLARENCE DELAFIELD, was then read. A special feature of the work is a "filter wall," consisting of two masonry walls, with apertures, the intermediate space being filled with sand.

The Secretary called attention to the fact that the drawing illustrating Mr. DELAFIELD'S paper was exceptionally well prepared for reduction for the Transactions; as a rule, he finds that drawings sent in have the figures so small as to be almost illegible when reduced to plate size. A resolution was adopted directing the Secretary to send out some instructions on this point, so as to make the illustrations in the Transactions of greater value for reference. This terminated the afternoon session.

The final meeting of the convention was held in the evening. The Secretary read an abstract of a long and interesting paper on "Ship Canals," by Mr. R. E. PEARY. The paper began with the canals of the early ages and dealt at considerable length with the ship canals in operation, under construction, and projected in America and foreign countries. Mr. WM. B. PARSONS then read a paper on "The Railways of Mexico," dealing mainly with traffic, rates, expenses, and general information, but giving also some data as to construction. It was stated that there are 4,500 miles of railway completed, with about 750 miles being built or to be built shortly; the routes of the different lines were described. The railways are said to be doing financially better now than ever before. The rails are light, 45 to 56 lbs. per yd., laid usually on Texas pine ties, sometimes on native durable wood; the track is generally ballasted with surface soil, and the bridge floors are very defective. The steel trough ties on the Mexican Ry., weigh 112 lbs. each, including fastenings, and cost about $1.25 f. o. b. in England at present prices. The author referred to a future time when the country might be a part of the United States.

After the reading of this paper, votes of thanks were tendered to the Chairman of the meetings (Mr. CROES); to the Committee of Arrangements, and especially its Chairman (Mr. MACDONALD); to the Tennis & Cricket Club, for offering the privileges of its house and grounds, and to the proprietor of the Octagon House for his care and attention in the interest of the convention. The meeting then adjourned.

The convention was successful and enjoyable, and was noticeable for the reasonable promptness of its meetings and the amount of work got through with. The attendance was not very large, but there were many of the older and more prominent members present. Towards the end, the attendance fell off considerably, as is generally the case, and partly for that reason an evening session was held on Tuesday so as to finish up the proceedings. Nearly all of the papers on the programme were read, either in full or in abstract, but the discussions were not very extensive except on the subject of the purity of water supply.

The exhibits were not many, but included the following: The Hartford steel tie, by the Hartford Steel Tie Co., of New York; the Excelsior nut locks and fish plate springs, by Ruffner & Dunn, of Philadelphia; rail sections cut with the Smith rail saw, by Manning, Maxwell, & Moore, of New York; and the "continuous" rail-joint, by the McConway & Torley Co., Pittsburg, Pa., This joint was described and illustrated in ENGINEERING NEWS, April 21, 1888. Also circulars of the Flower-Heiler metallic railway tie. A model of the Standard steel tie

was to have been exhibited by the Standard Tie & Mfg. Co., of New York, but as the convention adjourned a day ahead of the programme, the model was not on hand.

The following is a list of members attendant at the Convention :

J. W. ADAMS, J. L. ADAMS, Brooklyn, N. Y.; CHARLES ACKENHEIL, Elizabeth, N. J.; W. H. ATWOOD, Cleveland, Ohio; F. H. BALDWIN, Brooklyn, N. Y.; M. J. BECKER, Pittsburg, Pa.; CHARLES B. BRUSH, New York City; P. F. BRENDLINGER, Yonkers, N. Y.; A. G. BRINCKERHOFF, New York; H.W. BRINCKERHOFF, *Engineering and Building Record*, New York; JOHN W. BACON, Danbury, Conn.; JOHN BOGART, New York City; CHARLES J. BATES, Englewood, N. J.; O. E. MICHAELIS, Augusta, Me.; A. P. BOLLER, New York City; H. BISSELL, Salem, Mass.; L. F. BECKWITH, New York; T. W. BALDWIN, Bangor, Me.; C. P. BONNET, Dobbs Ferry, N. Y.; C. T. CHURCH, Saratoga, N. Y.; J. J. R. CROES, New York; J. F. CHOWELL, Cincinnati, O.; MENDES COHEN, Baltimore, Md.; Miss E. G. CRANS, New York; S. L. COOPER, Yonkers, N. Y.; A. G. COMPTON; A. CRAVEN, New York; S. H. CHITTENDEN, East River, Conn.; THEODORE COOPER, New York City; F. COLLINGWOOD, Elizabeth, N. J.; CHAS. DAVIS, Allegheny City, Pa.; C. DELAFIELD, New York; BENJAMIN DOUGLAS, Detroit, Mich.; JAMES G. DAGRON, New York; S. L. F. DEYO; R. L. ENGLE, Cincinnati, Ohio; A. FTELEY, New York; JAMES B. FRANCIS, Lowell, Mass.; M. FARGUSSON, J. FOSTER FLAGG, Brooklyn, N. Y.; B. GOODWIN, New York; C. S. GOWEN, Sing Sing, N. Y.; FRED GRAFF, Philadelphia; E. B. GUTHRIE, Buffalo, N. Y.; GEO. S. GREENE, Jr., New York; EDWARD GILLETTE, Jr., New Haven, Conn.; R. L. HARRIS, W. J. HASKINS, S. S. HAIGHT, New York; C. E. HEWITT, Trenton, N. J.; E. A. HERMANN, Indianapolis, Ind.; RUDOLPH HERING, New York City; R. L. HOXIE, Willetts Point, N. Y.; W. R. HUTTON, New York City; H. R. HOBART, *Railway Age*, Chicago, Ill.; GEORGE H. HENSHAW, Minneapolis, Minn.; W. E. HOYT, Rochester, N. Y.; JOHN HOUSTON, Jersey City, N. J.; W. H. JENNINGS, Columbus, Ohio; J. M. JACKSON, Easton, Md.; W. A. JEFFERIS, C. H. KELSEY, New York City; W. B. KNIGHT, Kansas City, Mo.; S. MUNCH KIELLAND, Buffalo, N. Y.; W. J. KEMAN; W. D. KELLY, Jr.; THOMAS B. LEE, New York City; G. LINDENTHAL, Pittsburg, Pa.; J. I. LIVINGSTON; WM. J. MCALPINE, New Brighton, N. Y.; HENRY C. MEYER, New York City; S. B. MCKEE, Greenville, Me.; T. H. MCKENZIE, Southington, Conn.; M. MERRIMAN, Bethlehem, Pa.; CHAS. MACDONALD, New York City; A. L. MILLS, Toledo, Ohio; T. SPENCER MILLER, New York City; FOSTER MORSE, Red Falls, N. Y; ARTHUR MACY, New York City; MACE MOULTON, East Berlin, Conn.; ELLIS B. NOYES, Ft. Edward, N. Y.; FRANK C. OSBORN, Pittsburgh, Pa.; J. E. OSTRANDER, Rochester, N. Y.; F. N. OWEN, New York; J. F. O'ROURKE, Amherst, Nova Scotia; A. B. PAINE, Poughkeepsie, N. Y.; JOHN A. PARTRIDGE, Washington, D. C.; R. E. PEARY, Philadelphia, Pa.; C. F. POWELL; W. BARCLAY PARSONS, New York City; H. G. PROUT, *Railroad Gazette*, New York City; P. C. RICKETTS, Troy, N. Y.; J. R. RICHARDS, Boston, Mass.; R. P. ROTHWELL, *Engineering and Mining Journal*, New York; GEO. S. RICE, New York City; GEORGE W. RAFTER, Rochester, N. Y.; BENJAMIN RHODES, Niagara Falls, N. Y.; WM. RUMBLE, Bayonne, N. J.; R. I. SLOAN, New York; T. GUILFORD SMITH, Buffalo, N. Y.; F. H. SMITH, Baltimore, Md.; M. H. SMITH, Jr., New York; C. C. SCHNEIDER, Philadelphia, Pa.; J. W. SCHAUB, Detroit, Mich.; H. B. SEAMANN, Philadelphia, Pa.. W. P. SHINN, New York City; F. W. SKINNER, *Engineering and Building Record*, New York; J M. STEWART, Dobbs Ferry, N. Y.; C. L. STROBEL, Chicago, Ill.; D. MCN. STAUFFER, ENGINEERING NEWS, J. H. STRIEDINGER, New York City; F. P. STEARNS, Boston, Mass.; J. C. STANTON; E. E. R. THATMAN, ENGINEERING NEWS, New York; A. N. TALBOT, Champaign, Ill.; CALVIN TOMKINS, New York; J. D. VAN BUREN, Newburg, N. Y.; H. L. VAN ZILE, Albany, N. Y.; J. R. VILLALON; J. R. WARDLAW, New York; FRED. C. WEIR, Cincinnati, Ohio; W. E. WORTHEN, New York City; N. J. WELTON, Waterbury, Conn.; S. WHINERY, Cincinnati, Ohio; J. E. WATKINS, Washington, D. C.; A. L. WEBSTER, New York; S. WHINERY, Cincinnati, Ohio

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The National Electric Light Association will hold a convention at Niagara Falls on August 6, 7 and 8. The Secretary of the Association is Mr. ALLAN V. GARRATT, 18 Cortlandt St., New York, and members are requested to notify him of papers to be read, and to suggest subjects, and the names of gentlemen best qualified to read papers, or to open discussions on the subjects named. Manufacturers and dealers in electrical supplies are also cordially invited to coöperate by sending on exhibits to the care of Mr. BENJAMIN RHODES, Chairman of the Executive Committee, at the Casino adjoining the International Hotel, Niagara Falls. Mr. GARRATT will forward on application a circular relating to arrangements made for transportation with the Trunk Line Passenger Committee.

Boston Society of Civil Engineers.—The regular monthly meeting was held at the rooms at the Boston & Albany Railroad Station on June 19. President FITZGERALD in the chair, 43 members and 14 visitors present.

The following were elected to membership: CHARLES H. BARTLETT, Manchester, N. H.; FRANK E. HALL, Quincy, Mass.; FRED. S. HUNTER, Boston; HIRAM NEVONS, Cambridge, Mass.

Mr. THOMAS DOANE gave a short account of the process of vulcanizing wood.

Mr. F. F. FORBES, Superintendent of the Brookline Water-Works, read an interesting paper entitled "Algæ Growths in Water Supplies" which was discussed by the President and Mr. STEARNS of the Society and by Prof. THOMAS M. DROWNE and Mr. G. M. RAFTER, of Rochester, N. Y.

After a general discussion of the failure of the dam at Johnstown, Pa., the Society adjourned.

S. E. TINKHAM *Secretary.*

The American Engineering Societies, for their present European tour, have organized the following joint Executive Committee :

Honorary Chairman.

D. J. WHITTEMORE, Past President A. S. C. E.

Chairman.

HENRY R. TOWNE, President A. S. M. E., Mem. A. S. C. E. M. I. M. E.

Committee.

O. CHANUTE, Past President A. S. C. E.
C. J. H. WOODBURY, Vice-President A. S. M. E., Mem. A. S. C. E.
THOMAS C. CLARK, Mem. A. S. C. E.
PROF. F. R. HUTTON, Secretary A. S. M. E., Mem. A. I. M. E.
WILLIAM H. WILEY, Treasurer A. S. M. E., Mem. A. S. C. E., Mem. A. I. M. E.
A. DEMPSTER, Mem. A. S. C. E.
WILLIAM KENT, Vice-President A. S. M. E., Mem. A. I. M. E.
JAMES ARCHIBALD, Mem. A. S. C. E.
S. W. BALDWIN, Manager A. S. M. E.
CLARK FISHER, Mem. A. S. C. E.
J. T. HAWKINS, Manager A. S. M. E.
DR. HERBERT G. TORREY, Mem. A. I. M. E.
GEORGE M. BOND, Manager A. S. M. E., Mem. A. S. C. E.
WILLIAM FORSYTH, Manager A. S. M. E. Mem. A. I. M. E.
OBERLIN SMITH. Mem. A. S. C. E., Mem. A. S. M. E., Mem. A. I. M. E.
E. V. D'INVILLIERS, Mem. A. I. M. E.

Treasurer.

ALFRED E. HUNT, Vice-President A. I. M. E., Mem. A. S. C. E., Mem. I. & S. Inst.

Honorary Secretary.

C. E. EMERY, Mem. A. S. C. E. Mem. A. S. M. E., Mem. A. I. M. E.

Secretary.

CHARLES KIRCHHOFF, JR. Manager A. I. M. E., Mem. A. S. M. E.

NOTE.—Abbreviations: A. S. C. E. represent the American Society of Civil Engineers; A. S. M. E. American Society of Mechanical Engineers; A. I. M. E American Institute of Mining Engineers.

Master Car-Builders' Association. *Annual Convention.*—The twenty-third annual convention of the Association was called to order by President WM. MCWOODS at 10.15 A. M., June 25, at Congress Hall, Saratoga Springs, N. Y., a large and representative proportion of the members being in attendance.

Mr. D. L. LOHNAS, President of the village, was introduced by President MCWOODS, and gave the members a hearty welcome to Saratoga. In reply, President MCWOODS said that the members' appreciation of Saratoga was shown by the fact that they had been here before, were here now, and in all probability would be here again.

The roll call and reading the minutes of the last meeting were dispensed with and the President read his annual address. He called attention to the rapid growth and prosperity of the many railway clubs, and thought the effective work they were now doing was to be credited largely to the interest which the national associations awakened. It is the task of the railway men of the country to see that the vast work of transportation and distribution is carried on in the most efficient manner with the least friction. To do this the Rules of Interchange have been established, and they have effected marvelous results in lessening the expense of transportation. Our system of interchange is the result of many years of study and experience by the Master Car-Builders of the country, and we do well to be proud of it. No such system exists anywhere else in the world.

There are indeed defects in it, for it is largely the result of compromises between those holding opposite opinions; and changes in practice and longer experience show us each year points in which it can be improved. But with all its defects, it is as great a success as most of human endeavors.

After reading his address President MCWOOD introduced to the convention Hon. ISAAC V. ROGERS, Chairman of the New York State Railroad Commission.

Mr. ROGERS said the New York Commission watched with great interest the efforts of the Master Car-Builders' Association to promote the objects for which it was established, and was well aware of the great benefits which had resulted from its work. He knew of no organization which had done so much to reduce the friction of transportation; and at the same time that it increased economy it had increased safety by the introduction of standards. Recently he happened to notice some statistics showing that in 1875 the average cost of freight transportation in the United States per ton per mile was a little over three cents. In 1888 it was eight-tenths of one cent. This result has been brought about largely through the improved methods introduced by this Association. He was well aware that the supervision of railroads by the State could only be successful when those who supervised in the interests of the people and those who supervised in the interests of the railways should work in harmony.

In conclusion he called attention to two technical matters of importance. He wished them to consider whether they had not about reached the limit of economical weight in freight cars. With the high speeds now growing so common, cars of 60,000 lbs. and over brought a terrible strain on rails, ties, and rolling stock, and especially on bridges. Was it not almost time to call a halt?

The other matter was proper ventilation. He had hoped that with the introduction of steam heat would come a general attempt to secure proper ventilation. Instead, nothing has been done, and the complaints to the Commission of this neglect were very numerous.

Hon. L. S. COFFIN, ex-Railroad Commissioner of Iowa, was then introduced, but spoke only briefly, desiring to speak later to the convention on the subject of automatic brakes and couplers.

The Secretary read his report showing the following membership:

	Active.	Representative.	Associate.
1888	138	90	5
1889	140	93	5

In 1888 the total number of cars represented was 755,743. Returns were not all in for the present year, but the prospects were that the total would show a slight increase.

The Association has no unpaid bills, but there are amounts now due for which bills have not yet been presented amounting to about $350. The members' dues in arrears amounts to about twice that, so the Association would have about $350 in its treasury if all outstanding dues were paid.

It was voted that the sessions during the present convention be from 10 A. M. to 1 P. M., and an afternoon session from 3 to 5 o'clock. The Secretary announced that the annual dues for the ensuing year would be $5 as usual. The President appointed the following as a Nominating Committee: Messrs. SCHROYER (C. & N.W.), TOWNSEND (Alton), VERBRYCK (C. R. I. & Pac.), ADAMS (Bost. & Alb.), and CHAMBERLAIN (N. Y. C. & H. R.)

It was voted that a committee be appointed to draw up an address testifying to the appreciation by the Association of the services rendered it by its retiring Secretary, Mr. M. N. FORNEY. Messrs. WALL (P. C. & St. L.), RHODES (C. B. & Q.), and LENTZ (Pa. & N. Y.) were appointed.

The following gentlemen were elected as auditing committee: J. N. BABB (C., M. & St P.), EUGENE CHAMBERLAIN (N. Y. C. & St. R.) and JOHN MACKENZIE (Nickel Plate).

Mr. ANGUS SINCLAIR was elected an Associate Member.

An amendment was offered to the by-law stating how the place of holding the annual convention shall be determined, and Messrs. MARDEN, MCILWAIN and SCHROYER were appointed a committee to revise the by-law.

The report of the committee appointed to formulate a code of rules for the interchange of passenger cars, including sleeping, parlor-chair, baggage and express cars, was read by the Secretary. The Committee, Messrs. BISSELL (Wagner Car Co.) and CHAMBERLAIN (N. Y. C. & H. R. R.), reported that they had found but little interchange of passenger cars existing, with the exception of the parlor and the sleeping cars run by the Pullman and Wagner companies. Such simple agreements as were needed had been made by those companies practising interchange, and were working so well that there seemed no need for the Master Car Builders' Association to concern itself in the matter. The only point on which any friction had arisen in the interchange of passenger cars had been through differences in the heights of the drawbar. It might, therefore, be advisable for the Association to adopt a standard height for drawbars for passenger cars.

The bad acoustic properties of the hall in which the sessions were held, brought about an adjournment at this point, and when the members reassembled at 3.20 P. M., the convention's quarters were changed to another hall.

The report of the above committee was then taken up and discussed in a somewhat rambling way. It was pretty generally agreed that in any case the subject of rules for passenger interchange were so much less important than other work before the convention that they could lie over for the present. A dispute arose as

to whether the Association had adopted a standard height for passenger drawbars, and if so, what that standard was. It was finally voted that a committee be appointed to inquire into the advisability of changing the height of drawbar on passenger cars and to see if it is advisable to adopt a new standard height.

One of the practical ideas brought out in this discussion was a suggestion of Mr. SCHROYER's that standards for brake levers and leverages on through cars were badly needed. Mr. MARDEN (Fitchburg), said the center of gravity of a car should be kept as low as possible if the car was to run easily and safely on curves. Mr. W. G. VAN BUSKIRK (Cleve. & Marietta) said that for very many roads it would be a great advantage to have the heights of couplers the same for passenger cars as for freight.

The Secretary then read the report of the committee on a standard journal box lid for 60,000-lb. and 40,000-lb. cars. The committee received 17 replies to its inquiries on this subject. Of these 13 favored the Fletcher lid and 3 the Hewitt drop lid. All were in favor of one size lid for any capacity of car.

It was voted that the committee be instructed to prepare drawings and submit them to the Association for letter ballot.

Mr. J. N. LAUDER then read the Report of the Committee on Journal Lubrication and the best practice in economizing oil. The report laid all stress on the fact that a dust-tight—and as nearly as possible air-tight—box was the great desideratum at present. Mr. LAUDER told of cars that were running on his Cape Cod division equipped with the Bemis box, which had run over 100,000 miles with a wear on the journal of less than $\frac{1}{4}$-inch The journals were 4 ins. x 8 ins. This box will run from two to three hundred miles a day for six months at a time without re-oiling.

Before adjournment the report of the Committee on Car Heating and Car Lighting was distributed. This committee, Messrs. F. L. SHEPPARD (Penna.), R. D. WADE (R. & D.), and ROBERT MILLER (Mich. Cent.), made a careful inquiry of the extent to which each of the various steam heating systems had been adopted. They received answers from 45 companies, who reported 735 locomotives and 1,572 passenger cars equipped with the steam-heating appliances of 12 different systems.

The committee was appointed with especial reference to finding a coupler for steam pipes between cars, which might be submitted for adoption as standard by letter ballot. The committee say, however, that they do not feel prepared to recommend any of the existing devices for a standard of the Association, for they believe that the interests of steam heating generally will be better served by awaiting a further development. They therefore recommend that the matter of a standard coupler for steam pipes between cars be left open for another year, when it is hoped that additional experience will aid in a wise selection, especially as the absence of such a standard need not materially hinder the application of steam-heating appliances to 90 per cent. at least of all passenger cars.

WEDNESDAY, JUNE 26.

At the opening of the morning session the officers for the ensuing year were nominated as follows: President, WM. MCWOOD (Grand Trunk); Vice-Presidents, C. A. SCHROYER (C. & N. W.), E. W. GRIEVES (B. & O.), J. S. LENTZ (Lehigh Va.); Treasurer, J. KIRBY (L. S. & M.S.); Executive Committee, R. C. BLACKALL (D. & H. C. Co.) F. CHAMBERLAIN (N. Y. Cent.), and F. D. CASANAVE (Penn. Co.) The convention then began the discussion of the Rules of Interchange, which occupied practically the whole day. The report of the Committee on Arbitration, Messrs. CASANAVE, RHODES, BARR, MILLER, and MCILWAINE, was then presented, and the Interchange Rules of 1888 were read by sections and adopted or changed according to the committee's report. On Rule 3, as to the defects for which cars may be refused, the committee's recommendations were adopted. It was also voted that "brake levers, heads and shoes, and all connections shall not be less than 1¾ ins. above the top of the rails." The vote was afterward reconsidered, and the clause was finally left as in the rules of 1888. Notice was given that at the next annual session a proposition would be made to require the use of safety chains or hangers on brake beams.

Other amendments to the rules were as follows: Clause *s*, Rule 3, concerning repairs noted by a defect card, was amended by striking out the last clause which made 6 months the limit of time during which the defect card was valid as a voucher. Rule 9, relating to the removal of wheels and axles, whether chargeable to owner, was amended as recommended by the committee. As it now reads it is an accurate guide as to the responsibility for defective wheels or axles. Rule 10, as to wheels loose and out of gauge, was stricken out. Rule 11 was changed to provide that in repairing cars owned by private companies, 10 per cent. shall be added to the cost of material and labor. Rule 12, concerning the home card on cars, was amended as proposed by the committee, but afterward a committee was appointed to consider a new form proposed by Mr. MACKENZIE.

Rule 15 was amended to provide that in describing defects in making bills for wheel and axle repairs, dimensions of the defect should be carefully noted. Rule 16 was amended by striking out the clause "provided it can be determined from the car itself," relating to making repair work conform in detail to the original construction. Rule 17 now provides that wheels shall be marked on inside with date and place of application, and that the wheel may be bored or the axle turned not more than $\frac{1}{8}$ in. to fit. Rule 18 was amended to provide for different types of splice for sills larger or smaller than 12 ins. Rule 23 was amended to provide that in case of a car with air brake apparatus being destroyed, the company destroying it may pay $50 to the owner, or else repair the broken parts and return the apparatus to the owner.

Rule 25 now provides that in making requisition for castings for making repairs, the pattern number shall be given. A clause was added to Rule 26 providing that manufactured articles shall be charged at current market price at the point used. Rule 28 was altered to provide that when a car is damaged or destroyed upon a private track, if it was delivered there by a company doing switching service for another, the company for whom the switching service is done shall be responsible. The name of the Arbitration and Revision Committee was changed to "the Committee on Revision of Rules and Settlement of Disputes arising under the same," and it was provided that in settling disputes notice shall be given to both parties interested to present any arguments in support of their side of the case if they wish to do so.

At the noon hour Hon. L. S. COFFIN, of Iowa, addressed the convention, urging the more rapid and general introduction of automatic brakes and couplers to avoid the present fearful slaughter of trainmen. The committee on a new by-law regarding the choice of a place for holding the annual convention reported a plan providing for the proposal of 12 places to be voted for by ballot; within 6 months thereafter, the Executive Committee to make a choice from the three places having the highest number of votes, provided satisfactory arrangements can be made at one of them. Amendments to the constitution were adopted, making joint car inspectors eligible to active membership, and providing that associate members shall not be dropped for failing to attend the conventions during three consecutive years.

THURSDAY, JUNE 26.

The report of the Committee on a Standard Brake Gear for air-brake cars, with a brake-shoe for iron beams (Messrs. E. B. WALL, G. W. RHODES and GEO. HACKNEY) was one of the most full and exhaustive submitted to the convention. The recommendations of the committee, which they recommended for submission to letter ballot, are as follows: (1) That the maximum train pipe pressure be 70 lbs. (2) That the brake power exerted on all freight cars be 70 per cent. of their light weight. (3) That the arrangement of brake gear for the various styles (with hand brakes at one or both ends and with brakes inside or outside connected) be according to the standard drawings submitted. (4) That all levers be 1 inch thick, all pins be turned to 1⅛-in. diameter, and fit within $\frac{1}{64}$ in., all jaws or clevises be of ⅞ × 2½ in. iron, all rods be of ⅞-in. diameter and all other details as shown on drawings. (5) Position of train pipe cock and dummy coupling to be as shown on drawings. (6) That the brake beams for all present forms of freight cars be required to stand a stress of 7,500 lbs. with a maximum deflection of $\frac{1}{10}$-in., and where it is necessary to use a stronger beam that it stand a stress of 15,000 lbs. with a maximum deflection of $\frac{1}{10}$-in. Where the Westinghouse beam is used, the plan shown on drawings be standard. (7) That where independent brakes and rubbers are used the present standard Christy or Collin rubber be maintained.

The Committee on a Standard Axle for Cars of 60,000 lbs. capacity reported an axle of the following dimensions, which will be submitted to letter ballot:

	Length.	Diameters.
Journal	8 ins.	4½ ins.
Wheel fit	7¼ "	5⅛ "
Collar	½ "	5½ "
Dust guard seat	2 "	5⅛ "

Length over all, 7 ft. 1 in. Length c. to c. of journals, 6 ft. 3 ins. Diameter at center, 4½ ins.

Mr. MCKENNA, of the committee, preferred a dust guard seat 2½ ins. long, and would make the lengths over all 7 ft. 2 ins., and length c. to c. of journals, 6 ft. 4¾ ins.

EXHIBITS AT THE CONVENTION.

The broad piazza around the inner court of the hotel made a very attractive exhibition room for the various railway supply firms. Nearly all the exhibits described in our last issue at the Master Mechanics' Convention at Niagara Falls were brought to Saratoga, and in addition a number of other firms were on hand. Car heaters and car couplers were especially prominent.

The Johnson Electric Service Co., of Milwaukee, showed their hermetic car-heater, thermostat and regulating valve, and Gibbs' patent coupling. The Peerless Coupler for car heating, made by the Automatic Coupler Co. of Detroit, Mich., was also represented.

Besides the car seats shown at Niagara Falls, the Lehndorf Car Seat Co. of Detroit, Mich., and the Wakefield Rattan Co., had interesting exhibits. The Russell & Irwin Mfg. Co., New Britain, Conn., showed a self-closing door for passenger cars, with air check. The Morrell reversible trailing deck ventilators, made by the International Mfg. Association, 10 Wall St., New York, and the Globe Ventilator Co., of Troy, N. Y., showed their devices.

In brake beams the "Central," made by the Michigan Ry. Supply Co. of Detroit, was shown by the selling agent, Thomas B. Inness; the "National Hollow," and the Westinghouse were also shown.

In couplers, the Dowling, the Nutting, the Van Dorston, the Skinner, the Janney, and the Timmes companies were represented. The latter company also showed their improved journal box. Couplers were also shown by Curley & Bailey, of Troy, and the Dunham Mfg. Co. A 70,000 lb. boiler car, made by HARRISON LORING, of Boston, and equipped with the Jewett all metal truck, the Marden brake beam and Loring's patent bolster, was shown at the Fitchburg station.

The Elmore oil box lid, Johnston's electric air signal, vulcanized fibre dust guards, Hutchins' freight car roof, Wright's patent fastener for bolts and nuts, the Eureka nut lock, and Cordley & Hayes' indurated fibre ware, were novelties of especial interest. The journal bearings shown by the old and reliable firm of bell founders, Geo. R. Meneely & Son, of Troy, N. Y., and the models of the Bradley cushioned hammer were of note among other exhibits.

RAILWAYS.

EAST OF CHICAGO—Existing Roads.

Lancaster & Hamden.—A correspondent, Mr. J. A. PRITCHARD, C. E., of Darbyville, O., writes us in regard to this enterprise to correct statements made in the letter of E. P. BUELL in the issue of June 22. He says in substance that the Lancaster & Hamden is defunct. It is a failure as an enterprise because of its terminal points, and no work has been done on it since the beginning of 1888. He also charges that Mr. BUELL is without personal means to carry out his work, and believes him unable to secure any other backing therefor. He further states that in making final estimates for the proposed road, to make the scheme an attractive one the earth quantities were cut down one-half, and it was represented that the maximum grades were only 1 per cent., whereas our correspondent knows of a 3-mile grade on his own residency which was over 80 ft. per mile.

As for the Point Pleasant, Adelphi & Northwestern, it is the old "Karshner" road, commenced and partly built from Cincinnati to the Hocking coal fields in the 70's.

We fully agree with our correspondent that it is for the advantage of both engineers and capitalists that the real facts regarding schemes of doubtful character be made known. In publishing letters sent us regarding these schemes, we never vouch for the authenticity of the statements made, although we shall not knowingly publish misrepresentations. Our correspondent writes a plain letter; and if his judgment is not at fault, the scheme to which he refers is not worth further mention, and he is deserving of the thanks of the profession for his "exposé." If Mr. BUELL wishes to present a defence of his statements recently sent us regarding his enterprise, our columns are open to him.

Canada.—The following is a partial list of the Canadian railways now in the process of construction together with the names of the officers to whom all communications should be addressed: Albert Southern, W. A. TRUMAN, Secretary, Albert, N. B.; Baie des Chaleurs, Hon. TH. ROBITAILLE, President, Quebec, P. Q.; Buctouche & Moncton, L. J. DE BERTRAM, President, St. John, N. B.; Central of New Brunswick, C. FORD STEVENS, President, Philadelphia, Pa.; Great Eastern, JAMES COOPER, President, Montreal, P. Q.; Great Northern, CHARLES N. ARMSTRONG, Montreal; Great Northwest Central, Hon. F. CLEMOW, President, Ottawa, Ont.; Irondale, Bancroft & Ottawa, CHARLES J. PUSEY, Vice-President and General Manager, Irondale, Ont.; Montreal & Western, E. RODIER, Secretary, Montreal; Nova Scotia Central, THOS. G. STEARNS, President, Middletown, N. S.; Ottawa & Gatineau Valley, C. H. MACKINTOSH, Vice-President, Ottawa; Qu'Appelle, Long Lake & Saskatchewan, GILBERT R. PUGSLEY, President, St. John, N. B.; Wood Mountain & Qu'Appelle, HUGH SUTHERLAND, President, Qu'Appelle, N. W. T.; Cape Breton, and Oxford & New Glasgow, COLLINGWOOD SCHREIBER, Chief Engineer and General Manager, Canadian Government Railways, Ottawa.

Montreal & Western.—This company is applying for a subsidy from the Canadian Government to aid in building an extension from St. Therese, P. Q., to Lake Temiscamingue.

Canadian Pacific.—Work is being pushed on the line from London to Windsor, and it is expected to have the road in operation by the end of the year.

Lake Shore & Michigan Southern.—This company reports the following results from operations for the six months ending June 30, 1889, as compared with the sam period in 1888:

	1889.	1888.
Gross earnings	$8,752,454	$8,671,805
Operating expenses	5,834,324	5,328,960
Net earnings	$2,918,130	$3,342,935

American Midland.—An injunction has been filed to prevent this company from laying its tracks across the Hancock county fair ground at Findlay, O.

Wabash Western.—Pursuant to an order of the Purchasing Committee, to go into effect July 1, the jurisdiction of this company has been extended over all lines east of the Mississippi river. The following appointments have been made: M. KNIGHT to be Freight Manager, with headquarters at St. Louis; H. L. MAGEE to be General Superintendent, having charge of transportation and maintenance of way, with offices at St. Louis; J. B. BARNS to be Superintendent of Motive Power, with offices at Springfield, Ill.; M. M. MARTIN to be Superintendent of the Car Department, with offices at Decatur, Ill.; and F. H. MCGUIGAN to be Superintendent of the Western Division, with headquarters at Kansas City. The surveys for the line to run from Wabash to Laketon, Ind., 10 miles, have been completed. A very favorable route is reported to have been secured.

Pennsylvania.—It is stated that work has commenced on the Waverly & New York Bay R. R., which is intended to furnish this company a short cut into New York. The road will be double-tracked.

New York, Lake Erie & Western.—Work has commenced double tracking the Orange branch of the Greenwood Lake R. R.—The engineers who commenced surveys some months ago, for the purpose of finding the most feasible route for a short cut between the company's coal fields and the east, have finished their surveys. It is stated that the route selected runs from Forest City east to a connection with the Erie & Wyoming branch at Middle Valley, a distance of about 25 miles. The maximum grade will be about 90 ft. per mile. All ore coming from these mines is now shipped by the Jefferson branch to Susquehanna and thence by the main line to New York, a distance of about 226 miles. The projected line, if built, will shorten the distance about 60 miles.

Michigan Central.—The report of this company for the 6 months ending June 30, 1889, shows the following results from operations as compared with the same period in 1888:

	1888.	1889.
Gross earnings	$6,233,000	$6,535,000
Operating expenses	4,424,000	4,725,000
Net earnings	$1,809,000	$1,810,000

Baltimore & Eastern Shore.—The contract for building the bridges on this road, which is to run from Broad Cove to Salisbury, Md., 54 miles, has been let to M. S. Carter & Co., of St. Louis, Mo.

Brantford, Waterloo & Lake Erie.—The grading and bridging is nearly completed on the lines from Brantford to Waterford, Ont., 17 miles, and tracklaying will begin soon. Nihan, Elliot & Battle, of Brantford, Ont., are the contractors.

Rockaway Valley.—About 2 miles of the extension from New Germantown to Pottersville, 4 miles, has been graded ready for the rails. J. V. MELICK, of White House, N. J., is Chief Engineer.

Mt. Gretna.—This narrow-gauge road, which runs from Mt. Gretna Park to the top of Governor Dick Mt., a distance of 7½ miles, has been opened for traffic. ROBERT H. COLEMAN, of Lebanon, Pa., is President.

Projects and Surveys.

Phillips & Rangeley.—We have received the following information from F. E. TIMBERLAKE, of Phillips, Me., Secretary:

This road is projected to run from Phillips through the towns of Madrid, Redington and Dallas, to Rangeley village, a distance of 27 miles. The route is through a country rich in forests of hardwood spruce, cedar and pine timber. There are several large lumber mills at Madrid and Rangeley. The road will be 2-ft. gauge, laid with 35 lb. per yd steel rails, and is estimated to cost about $6,000 per mile. It will probably be operated in connection with the Sandy River R. R. The principal business will be in the transportation of lumber, although a considerable amount of passenger traffic is expected from sportsmen and tourists. No right-of-way has been secured. H. P CLOSSEN, of Gardiner, Me., is President.

Ohio & Northwestern.—Incorporated in Pennsylvania to build a line of railway from a point on the Youghiogheny river near Smithton to the village of Latrobe, a distance of 25 miles. Among the incorporators are; J. J. MILLER, of Pittsburg, and JAMES CAMPBELL, of Allegheny.

Woonsocket & Huntsville.—It is stated that survey have been made and capital secured for a railway to run from Woonsocket to Huntsville, R. I., a distance of about 15 miles.

SOUTHERN.—Existing Roads.

Mary Lee Coal & Railway Co.—J. A. MONTGOMERY, of Birmingham, Ala., President, writes us that this comny has let the contracts for building lines of railway from Birmingham to Lewisburg, Ala., 4½ miles; from Birmingham to Forest City, 1¼ miles; from Lewisburg to Mine 3, 1½ miles, and from Lewisburg to Mine 2, 1¾ miles, to Dunn Bros. & Co. Work is now in progress.

Central R. R. of Georgia.—The contract for building that portion of the Savannah & Western R. R. between the Ogeechee river and Ohoope, Ga., 60 miles, will be let soon.

Chattanooga, Rome & Columbus.—It is stated that this company is considering building an extension to run from Columbus, Ga., via Warm Springs, to Cordele, Ga., a distance of about 65 miles.—Reports are in circulation that this company and the Columbus Southern R. R. Co. will be consolidated and form a through line from Chattanooga to Quincy, Fla., by means of a road to run from Dawson, Ga., to Quincy, which will be built by the Florida Railway & Navigation Co.

Louisville, New Orleans & Texas.—It is announced that this company will build a branch from Lula, Miss., to a point on the Mississippi river opposite Helena, Ark.

Orange Belt.—A press report states that this road will soon be changed to standard-gauge.

Chattanooga Union.—Poe & Frye, of Chattanooga, have the contract for extending this road from East End to Mountain Junction, 2¾ miles.

Louisville, St. Louis & Texas.—This company, it is stated, will build a branch from Irvington to Hardinsburg, Ky.

Alabama, Midland.—Rapid progress is being made on this road. The grading through Henry county is practically completed, and tracklaying between Gordon and Dothan, Ala., is progressing at the rate of 1 mile per day.

Cincinnati, Alabama & Atlantic.—A mortgage of $7,000,000 has been made to the Mechanics' Savings Bank & Trust Co., of Louisville, Ky., by this company. The money is to be used in building the line from Tullahoma, Tenn., to Somerset, Ky. Locating surveys have already been commenced under the direction of the Chief Engineer, O. H. R. CORNELL, of Tullahoma.

Louisville Southern.—Tracklaying on the line from Versailles to Lexington has been completed to a point 4 miles east from Versailles. About 300 ft. of the iron work of the bridge across the Kentucky river at Tyrone has been swung into position. Work on the iron bridge across Elkhorn creek will commence soon.

Projects and Surveys.

Knoxville & Northeastern.—This company has been incorporated in Tennessee by W. K. MORRISON, of Chattanooga, T. M. STEGER, of Nashville, J. P. MCDONALD, of Knoxville, and others, to build a railway from Knoxville to Dandridge, Jefferson county, with branches from the main line to Sevierville and Newport. The object of the road is to open up large iron mines.

Wadley & Mt. Vernon.—Incorporated in Georgia to build a line of railway from Wadley, Jefferson county, to Mount Vernon, Montgomery county, a distance of about 55 miles. The capital stock is $200,000.

Leeds & Gadsden.—Right-of-way is being secured for this road which is projected to run from Leeds to Gadsden, Ala., a distance of 40 miles. G. M. THOMASON, of Cornelia, Ala., is interested.

Georgia.—Bills will be introduced into the next session of the legislature to incorporate the Collins Park R. R. Co. and the Franklin, Jonesboro & Covington R. R. Co.

NORTHWEST.—Existing Roads.

St. Paul, Minneapolis & Manitoba.—J. M. SPICER, of Wilmar, Minn., President of the Wilmar & Sioux Falls R. R. Co., writes us that the Sioux Falls, Yankton & North Platt R. R. is a continuation of the Wilmar & Sioux Falls R. R. and will run from Sioux Falls to Yankton, Dak. It is not probable that the road will be built this year.

Duluth & Winnipeg.—A press dispatch from Winnipeg, Man., states that this company has decided to do no more work on the road until the land grant question has been finally settled.

Northern Pacific & Manitoba.—Work is being pushed on the bridge across the Assiniboine river and it is expected that it will be completed in time to permit of the line being opened for t by August 1.

Pacific Short Line.—Tracklaying will soon begin on the Nebraska & Western division of this road.

Canadian Pacific.—It is stated that this company will soon commence work on the old grade of the Barnsley branch, which was projected to run from Barnsley southwest to Boyne, Man., on the Boyne river, a distance of about 55 miles.

Chicago, Burlington & Quincy.—Commencing the first of July, the road running from Burlington, Ia., to Keokuk, Ia., 42 miles, now known as the Keokuk & St. Paul R. R., will be operated by the St. Louis, Keokuk & Northwestern R. R. The line from Burlington to Quincy, Ill., 72 miles, now operated as a part of the Iowa system, will be operated as a part of the Illinois system, and the lines in Iowa will be operated in two divisions instead of three as heretofore. The reason of this move is to reduce expenses.

Jacksonville Southeastern.—Judge J. PHILLIPS, of the Illinois Circuit Court, has issued an order placing this road in the hands of a receiver. The order was issued on the petition of E. SOUTHWORTH, of Litchfield, Ill., The petition was based upon the grounds that the company refused to pay a judgment obtained against it for personal injuries received by the complainant in a wreck on the company's road in March, 1887.

Projects and Surveys.

Waukegan & Southwestern.—Incorporated in Illinois to build a railway from Waukegan to a point near Hanover Station, on the Elgin, Joliet & Eastern R. R. Among the incorporators are: CHAS. S. HOLT, of Lake Forest Wis., A. T. TOWNE, and ARTHUR D. WHEELER, of Chicago.

Milbank, Egan & Sioux City.—Organized in Dakota to build a railway from Milbank south to Egan, Moody county, a distance of about 90 miles. Among the directors are: D. W. DIGGS, of Milbank, ALFRED BROWN, of Egan, and others.

Sioux Falls Southern.—A project is rumored on foot to build a railway from Sioux Falls, Dak., south along the western borders of Iowa, Missouri, Arkansas, and Louisiana to an outlet on the Gulf of Mexico.

Chicago Circle.—Incorporated in Illinois to build a railway connecting the Chicago, Milwaukee & St. Paul and the Chicago & Evanston railways, running from a point on the former road near Cragen to Deering Station, Lake View. Among the incorporators are: C. W. SMITH, of Chicago, GEO. H. PARKER, C. M. GERTZ, and ANDREW DUNNING, of Jefferson.

SOUTHWEST.—Existing Roads.

Missouri, Kansas & Texas.—A press dispatch quotes Receiver GEO. A. EDDY as saying that this company has purchased the Kansas City & Pacific R. R. and will extend it into Kansas City. The contract for building the extension between Lancaster & Waxahachie Tex., a distance of 17 miles, has been let to J. P. Hughes, of Fort Worth, Kan.

Paris, Marshall & Sabine Pass.—At a meeting of the directors recently held, the following officers were elected: D. H. SCOTT, President; R. D. HASLIP, Vice-President; B. J. BALDWIN JR., Secretary; E. J. FRY, Treasurer; and J. W. HART, General Manager. Arrangements are nearly completed for commencing construction.

Arkansas Midland.—It is expected that work will soon commence on the extension from Clarendon to Little Rock, Ark., a distance of about 50 miles.

Atlantic & Pacific.—Inducements are being offered to this company to build a line from Albuquerque, N. M., to within 7 miles of San Pedro, a distance of about 35 miles. The gap from the end of the proposed road to San Pedro, 7 miles, will be built by private capital.

Missouri Pacific.—Surveys a rereported in progress for a line to run from Fort Scott, Kan., via Rich Hill, to Appleton City.

Mississippi River & Bonne Terre.—Work is approaching completion on this road, which runs from Bonne Terre, Mo., north to Crystal City, Mo., about 30 miles. Grading has been completed and tracklaying is being pushed. It is expected to have the road in operation by Sept. 1. It is announced that upon the completion of the line north, surveys will be made for an extension south to Doe Run, to open up the lead mines in that vicinity.

Red River, Sabine & Western.—Work on this road is progressing rapidly. About 10 miles of the line between Nacogdoches and San Augustine has been graded, and tracklaying will soon begin. Work will soon commence on the line between Nacogdoches and Palestine, Tex.

Houston, Central Arkansas & Northern.—Twenty-five miles of the line between Monroe and Pine Bluff, Ark., has been graded ready for the rails.

Cleveland, St. Louis & Kansas City.—Work on construction, which was abandoned some time ago, owing to the cancellation of the contract by Baird & Co., the contractors, will, it is stated, be resumed within a few days. About 70 miles of the grading has been completed.

San Antonio & Aransas Pass.—The $10,500 bonus asked of the citizens of Laredo has been subscribed, and it is expected that the road will be in operation by March 1, 1890. The road runs from Kennedy Junction to Laredo, 150 miles, and will open up a fine agricultural country. Preliminary surveys for the line were completed some time ago. Work is being pushed on the branch to Waco. The old roadbed of the Waco & Brazos Valley R. R. will be used for the greater part of the way. Contracts for equipping the entire line have been let.

Southern Pacific.—Work is being pushed on the line from Goliad to Beeville Tex.

Kansas City & Excelsior Springs.—Incorporated in Kansas to build a line of railway from Missouri City to Excelsior Springs, a distance of 8 miles. Hammett, Davison & Co., bankers, of Kansas City, are at the head of the enterprise.

Houston Belt & Magnolia.—Surveys are in progress on this road, which is to run from Houston to Port Houston, Tex., 4 miles. Work will commence as soon as the surveys are completed.

Projects and Surveys.

Kansas City & Suburban Belt.—It is announced that the capital stock of this company has been sub-

scribed by Philadelphia capitalists and that the construction of the road will soon commence. The object of the road is to furnish a belt line transfer for the various railways entering Kansas City. E. L. MARTIN, of Kansas City, is President.

Fort Scott, Pittsburg & Southern.—Chartered in Kansas to build a line of railway from Fort Scott, via Pittsburg, south through the counties of Bourbon, Crawford, Cherokee, La Bette, Linn, Allen and Anderson, in Kansas, and the county of Jasper in Missouri. Among the incorporators are C. H. HAMMETT, of Kansas City, Mo., and W. D. FORD, JOHN L. LINDBURG and F. W. LANGON, of Pittsburg, Kan.

Alexandria & Gainesville.—The citizens of Gainesville, Tex., are agitating the project of building a railway from that place to Alexandria, La.

Appleton City Southeastern.—A project is on foot to build a line of railway from Appleton City, Kan., southeast to the Johnson City coalfields, about 10 miles.

ROCKY MT. AND PAC.—Existing Roads.

Montana Central.—It is announced that this road will be extended to Anaconda, Mont., in the near future. Surveys are already in progress.

Oregon Pacific.—The contract for building 20 miles of this road east from the end of track to near the summit of the Cascade mountains has been let to J. S. Antonelle and Loring B. Doe, of San Francisco. Work is to begin at once.

Pacific Short Line.—The city of Ogden, Utah, has granted the Salt Lake Valley & Eastern R. R. a subsidy in cash and franchises in the shape of right-of-way, depot grounds, etc., amounting to $300,000.

Oregon & Washington Territory.—Work has commenced on the branch from Walla Walla to Whetstone Hollow, a distance of 45 miles. It is expected that the road will be completed by Sept. 1.

Oregon Railway & Navigation Co.—At the meeting of the directors recently held, the following officers were elected: EDMUND SMITH, Philadelphia, President; W. S. LAND, Portland, Ore., first Vice-President; W. H. HOLCOMB, Omaha, Neb., second Vice-President; and THEODORE WYZANT, Portland, Secretary.

San Gabriel Valley.—Tracklaying is now in progress on the branch of this road from Ramona to Pasadena, Cal.

Rio Grande Western.—Articles of consolidation of this company and the recently incorporated State Line & Denver R. R. Co., have been filed. The officers of the consolidated companies are: D. C. DODGE, President, W. F. COLTON, Secretary, and C. W. DRAKE, Treasurer.

City & West Portland Park.—T. A. WOOD, of Portland, Ore., writes us that the surveys for this road, which is to run from Portland to West Portland, a distance of 6 miles, will commence about July 15. All the right of way and about $45,000 in subsidies have been obtained. The road will do passenger business only. It is expected to have it in operation by December. C. W. BROWN, of Portland, is Chief Engineer.

Southern Pacific.—It is stated that this company has purchased the Oregonian and Portland & Willamette Valley railways.

Denver, Colorado Canon & Pacific.—The surveyors of this line have reached Hite City, Utah. They report a somewhat difficult passage, but state that an excellent line for the road has been secured. The country is rich in mines of gold, silver, coal and other minerals. One half of the corps will remain at Hite City and the remainder will continue the survey down the cañon.

Projects and Surveys.

Los Angeles, San Diego & Yuma.—It is stated that the contracts for the grading and tracklaying on this road from San Diego to National City, a distance of 5 miles, have been let and work will begin at once. Contracts have been let for 1,100 tons of 56-lb. steel rail, two 25-ton Baldwin locomotives, 4 passenger cars, 4 freight cars and ten 20-ton flat cars. The principal officers of the company are at San Diego.

Siuslaw & Eastern.—At a meeting of the projectors recently held, it was voted to make the surveys for that portion of this road between Florence and Eugene, Ore., immediately. WM. C. COX, of Salem, Ore., is interested.

Tacoma & Silver Beach.—Incorporated in Washington Territory to build a railway from Tacoma to Steilacoom. Among the incorporators are E. E. BLAIR and T. W. LOOMIS.

Albany & Astoria.—Incorporated in Oregon to build a railway from Astoria to Albany. Among the incorporators are: JAS. S. COWAN, W. B. BABB and E. J. LANNING. The principal offices will be at Albany.

RAPID TRANSIT.

Electric Railways.—*Bar Harbor, Me.*—The State Railroad Commissioners have extended for 3 years the franchise for an electric railway 3 miles long from Bar Harbor to Green Mountain; the line will be operated in connection with the rack railway up the mountain. F. H. CLERGUE and F. A. LAUGHTON, of Bangor, Me., are interested.

Saratoga, N. Y.—An electric railway to Geyserville is projected by Major J. L. BUTMAN.

Washington, Pa.—The Washington Electric Street Ry. Co. has been organized. Capital stock, $60,000.

Middlesborough, Ky.—The Middlesborough Electric Street Ry. Co. is to be organized, with a capital stock of $50,000.

Nashville, Tenn.—The McGavock & Mt. Vernon Street Ry. Co., which has been using electricity, will extend the system over all its lines.——The City Electric Ry. Co. has been organized by I. T. RHEA, R. W. TURNER, P. G. BREEN, and others.

Cleveland, O.—An electric line for the East End is projected. Storage battery cars are to be used.

St. Paul, Minn.—An electric railway 6 or 10 miles long to the Summit Ave. boulevard is to be built by Thomas Lowry.

Waterloo, Ia.—A franchise has been granted for the operation of the street railway by electricity. There will be a branch to Cedar Falls.

Santa Fé, N. M.—An electric railway is one of the newly projected enterprises.

Dummy Lines.—*Birmingham, Ala.*—The Birmingham, Bessemer & Powderly Ry. Co. has let contracts to J. H. Parsons and J. M. Lovelace.

Salem, Ore.—The Marion County Improvement Co. intends to build a motor line to Silverton.

Cable Railways.—*Pittsburg, Pa.*—The Central Traction Ry. Co. has let the contract for its new power house to C. A. Ralph, at $57,750.

Baltimore, Md.—The Baltimore Traction Co. has acquired the Citizens' and Peoples' lines, and will put in a cable system.

Minneapolis, Minn.—A new company has been applying for an extensive franchise for cable roads, but the present company claims to have an exclusive franchise.

Pneumatic Motors.—It is reported that an agent for the government of New South Wales has made a contract with a pneumatic motor company in New York, in which W. W. DUDLEY and JAY COOKE are interested, to use the inventions on street railways in the colony.

The American Cable Ry. Co., of New York, has increased its capital stock from $2,000,000 to $3,000,000.

Street Railways.—*Pittsburg, Pa.*—The Forbes Street Ry. Co., the East End Street Ry. Co., and the Hiland Ave. Ry. Co., have been incorporated in the interest of the Fifth Avenue Traction Co.; the 3 lines are continuous, forming a line 17 miles long, from Boyd St. to the Hiland Ave. reservoir. Capital stock, $42,000, $36,000 and $24,000. GEORGE I. WHITNEY, H. S. A. STEWART, and GEO. RICE are interested.

Hampton, Va.—The Hampton & Old Point Ry. Co. is getting estimates on the cost of building its road.

Chattanooga, Tenn.—The Chattanooga & North Side Street Ry. Co. has been organized by J. A. HART, W. B. MITCHELL and S. R. READ.

Columbus, Ga.—A street railway to Wynton will be built by Albert Shepherd.

Montgomery, Ala.—The Montgomery Belt Line Ry. Co. has awarded the contract for grading and tracklaying to S. G. Pruitt.

Greenville, Ala.—A street railway ½ mile long, is to be built by J. T. STEINER and J. F. STALLINGS.

Hammond, Ind.—The East Chicago, Hammond & Hegewisch Street Ry. Co. has been incorporated by J. W. ULM, S. A. STEVENS, and JOHN C. POLLEY. Capital stock, $500,000.

Kansas City, Mo.—The Second Street Belt Ry. Co. has been incorporated by Major B. F. JONES, A. E. STILLWELL and E. L. MARTIN.

Sulphur Rock, Ark.—The Sulphur Rock Street Ry. Co. has been organized by J. W. S. BRACKEN, and W. T. NESBIT. Capital stock, $3,000.

CONTRACTING.

Construction Material.—At Washington, D. C., contracts have been made with the following persons for the furnishing and delivery of construction material for street improvements during the fiscal year 1889-90: Granite curb to Shields & Neelon, John Booth, the Brandywine Granite Co., the Virginia State Granite Co., and Samuel Emery; asphalt blocks and asphalt tiles to the Maryland Paving Co.; paving and arch bricks to the Washington Brick Machine Co. The commissioners have opened bids for furnishing the district with cast-iron water pipes and valves, terra cotta sewer pipe, and sand, granite and broken stone. The bidders for terra cotta sewer pipe were A. Lamond, Globe Sewer Pipe Co., Thos. Somerville & Sons, and the American Sewer Pipe Co.; for cast iron water pipe, J. T. Springman & Sons, McNeal Pipe & Foundry Co., Edward L. Dent, Henry A. McShane & Co., Anniston Pipe Co., Chas. E. Barber for the Howe Stevens Manufacturing Co., Wm. Runkle, Shepherd & Hurley, Camden Iron Works, Frederick C. Vinney; for sand, Henry Lyles.

Sewer Pipe.—The Sanitary Committee, Montgomery, Ala., has awarded the contract for furnishing sewer pipe to McMahon, Porter & Co., of New Cumberland, W. Va. The City Council has decided that in future the city will build its sewers instead of having them built by contract.

Dredging.—The following proposals for dredging about 150,000 cu. yds. of material were opened June 19 by N. H. HUTTON, Engineer to the Harbor Board, Baltimore, O.: C. W. Nelson, Jr., Baltimore, 10 cts. per cu. yd. from harbor and dredged channels, 10 cts. per cu. yd. from Spring Gardens, 37 cts. per cu. yd. near Lazaretto Point (hard bottom); W. B. Brooks, Jr., Baltimore, 14¾, 15¾ and 37 cts.; Baltimore Dredging Co., 14, 15 and 35 cts.; L. J. Fobes, Baltimore, 14½, 16 and 40 cts. All bids were rejected.

Street Work.—*Richmond, Va.*—Contracts have been awarded as follows by W. E. CUTSHAW, City Engineer: Spall paving, roadbeds: Alois Rick, 95 cts. to $1.06 per sq. yd. according to location; Thos. Barry, 98 cts. to $1.04. Granite gutters: Alois Rick, 95 cts. to $1.03 per sq. yd.; Thos. Barry, 95 cts. to $1.04½; J. A. Weissbrunn, 96 cts. to $1.04. Curbing, James Netherwood, 22,000 ft., 82 cts. per lin. ft. Corner curbing: James Netherwood, $7.50 each. Circular curbing: Hutcheon & Donald, $1.30 per lin. ft. Flagging: James Netherwood, 52 cts. per sq. ft.

Brooklyn, N. Y.—Bids opened recently for granite block paving ranged from $2.23 to $3.33 per sq. yd.

Detroit, Mich.—The contract for Telford granite paving on Theodore St. has been awarded to John A. Stewart at $2.54 per sq. yd., or $13,887.72.

Asphalt Paving.—At Syracuse, N. Y., the contract for Trinidad asphalt paving on Townsend and James Sts. has been awarded to the Warren-Scharf Asphalt Paving Co.——At Detroit, Mich., the same company bid $3.33 per sq. yd., or $27,031.54, for paving Hancock Ave.

Cement and Stone.—The following proposals have been received by the Docks Commissioners, New York City: For 500 bbls. of quick setting Portland cement: James Brand, $2.40 per bl.; Dickinson Bros. & King, $2.41; Marcial & Co., $2.50; A. C. Babson, $2.50; Haibler & Co., $2.55. The contract was awarded to James Brand. For 500 cu. yds. of stone: Daniel C. Donovan, $1.64 per cu. yd.; Hudson River Broke Stone Co., $1.65; West Shore Trap Rock Co., $1.73; J. A. Bouker, $1.73; Brown & Fleming, $1.75; A. J. Howell, $1.80. The contract was awarded to D. C. Donovan.

Jail.—The contract for a jail at Bloomfield, Greene Co., Ind., has been awarded to the Pauly Mfg. Co., of St. Louis, Mo.

Court House.—The contract for iron work for the basement and sub-basement of the new court house at Minneapolis, Minn., has been awarded to the Crown Iron Works, of Minneapolis, at $23,518.50 for cast-iron, and $40,509.31 for floor beams and channels.

Fire Hose.—The Fire Committee, Winnipeg, Man., has ordered 500 ft of the Baker fabric hose from the Gutta Percha & Rubber Mfg. Co., at 90 cts. per ft. delivered, with couplings; and 500 ft of the Paragon hose from the Toronto Rubber Co., at 88½ cts. per ft.

Trenching and Joint Packing.—The following proposals for excavating trench for 20,000 ft. of 48-in. main, 5,400 ft. of 30-in., and 400 ft. of 24-in., about 38,000 cu. yds., were opened June 20 by Col. JOHN M. WILSON, U. S. A., at the office of the Washington aqueduct, Washington, D. C.: T. B. Coyle, 24 cts. per cu. yd. for earth, $2.70 per cu. yd. for rock; John Dugan, 38½ cts., $1.52½; Wm. Ryan & Co., 39½ cts., $2; D. Looney, 39 cts., $3.49; Lyons & O'Brien, 46 cts., $1.96; Cotter T. Bride, 45 cts., $2.50; Andrew Gleeson, 47 cts., $2.23; A. Davis, Jr., 63 cts., $1.25; Owen Patterson, Baltimore, Md., 70 cts., $1.50; Wm. H. Mohler, 71 cts., $1.65; M. F. Talty, 38 cts., no bid. All the bidders, except O. Patterson, were Washington parties. For 100 tons of lead and 4,000 lbs. of jute: Clendenin Bros., Baltimore, Md., 4.24 cts. for lead; Rowland A. Robbins, New York, 4.39 cts. for lead, and 7.90 and 11.40 cts. for jute; Wm. C. Codd, Baltimore, 4.60 cts., 6.95 cts. for jute. There were no bids for patent jointers.

Dike.—The following proposals for a brush dike for improving the James river were opened June 20 by Col. C. P. E. BURGWYN, U. S. Engineer Office, Richmond, Va.: J. F. Bradley, Manchester, Va., 95 cts. per lin. ft.; W. Jaimson, Berkley, Va., $1.06; Cline & Isaac, Richmond, Va., $1.19; Geo. E. Ward, Richmond, Va., $1.19; W. Hampton Curtis, Richmond, Va., $1.44; S. D. Skinner, Wilmington, N. C., $1.50; L. A. Guy, Richmond, Va., $1.54; David P. Howell, Monroe, N. Y., $1.67½; Chas. Bliven, Norfolk, Va., $1.69; Ronald Gillies, Brooklyn, N. Y., $1.73. The contract was awarded to J. F. Bradley.

PROPOSALS OPEN.

Bridge.—At Pearl St., New Albany. Plans prepared by City Engineer COLEMAN. THE COUNTY BOARD, New Albany, Ind.

Bridge.—Across Smith River. C. S. HAMLIN, Leaksville, N. C. July 15.

Bridges and Culvert.—Stone culvert, 80 ft. iron bridge, 2 wooden bridges. F. J. O'FLAHERTY, County Surveyor, Water-Works Building, Kansas City, Mo. July 16.

Engine.—Automatic steam engine of 50 H. P. for the State Reformatory, St. Cloud. GORDON E. COLE, 324 Jackson St., St. Paul, Minn. July 18.

Bridge.—Rebuilding iron bridge of 12 spans over the Rappahannock river. GEORGE J. LIGHTNER, Treasurer of the Bridge Commissioners, Falmouth, Va. July 20.

Jail Work.—Eight steel cells for county jail. A. R. SMITH, Clerk of Road Commissioners, Gainesville, Ga. July 22.

Sewer.—At Brooklyn village, O. H. M. FARNSWORTH Village Clerk, 219 Superior St., Cleveland, O. July 23.

Jetty.—Timber jetty in Trinity river. Major O. H. ERNST, U. S. Engineer Office, Galveston, Tex. July 26.

Bridges and Viaducts.—Substructures and Superstructures. Bidders must submit plans. Several plans, specifications, and dimensions on file in the offices of the County Engineer and County Auditor. THE HAMILTON COUNTY BOARD OF COMMISSIONERS, Cincinnati, O. July 27.

Water-Works.—Complete system, with contract for 15 years. THE WATER COMMITTEE, Helena, Mont., August 1.

Pumping Engine.—Daily capacity, 15,000,000 galls. THE BOARD OF PUBLIC WORKS, Nashville, Tenn. August 1.

Bridges.—Two bridges. Bidders must furnish plans and specifications. THE COMMISSIONERS OF WASHINGTON COUNTY, Brenham, Tex. August 12.

MANUFACTURING AND TECHNICAL.

Locomotives.—The Taunton Locomotive Mfg. Co., of Taunton, Mass., has built 2 new engines for the Boston, Revere Beach & Lynn.

The New York Locomotive Works, of Rome, N. Y., have an order for 4 eight-wheel engines for the Mobile & Ohio.

The Rogers Locomotive Works, of Paterson, N. J., have built 4 engines for the Nova Scotia Central.

The Baldwin Locomotive Works, of Philadelphia, Pa., have received an order for 76 engines for the Northern Pacific.

Ryan & McDonald, of Waterloo, N. Y., are building several 5-ton engines for contractors' use and for Southern lumber roads, all narrow gauge.

The Montana Union Ry. Co. is having 12 consolidation engines built; 6 will have 20x24-in. cylinders, 3 will have 22x28-in. and 3 will have 18x26-in.

The Rio Grande Western will order 10 passenger and 25 freight engines for the new standard gauge service.

Logging Railways.—The Nashville Lumber Co., of Nashville, Tenn., will build 6 or 8 miles of logging railway.

W. J. McDiarmid & Bro., of Spout Spring, N. C., will build 3 miles of logging railway.

J. E. Lockley, of Mobile, Ala., and J. O. Thompson, of Pensacola, Fla., will build a logging railway 6 miles long near Mobile.

Pumping Engines.—The Smith Vaile Co., of Dayton O., is building for Willett E. McMillan, of Paris, Ill., a set of 3,000,000 galls. compound pumping engines for Seymour, Ind. It has also under construction one 3,000,000 galls. pump for Grand Rapids, Mich., and one 1,500,000 galls. pump for Eau Claire, Wis. They are all for delivery before July 20.

The Pond Engineering Co., of St. Louis, Mo., has sold to the American Water-Works & Guarantee Co., a 125 H. P. Hoppes feed water heater, and duplex pump for North Platte, Neb.; and another heater and pump, same size, for Wahoo, Neb. Several large orders have been filled for Sheffield grate bars in the southwest. The company is resetting 4 boilers with the Jarvis furnace for the Quincy Paper Co., Quincy, Ill.

Cars.—The Litchfield Car & Machine Co., of Litchfield, Ill., is building 200 refrigerator cars for the St. Louis, Belleville & Southern Illinois.

The Ohio Falls Car Co., of Jeffersonville, Ind., has an order for 200 fruit cars for the Louisville & Nashville.

The U. S. Rolling Stock Co., of New Decatur, Ala., has turned out 20 fruit cars for the Georgia Central.

The Missouri Car & Foundry Co., of St. Louis, Mo., has an order for 300 refrigerator cars for the Louisville & Nashville, and 300 box cars for the Wabash Western.

The Indianapolis Car Co. has completed 100 fruit cars for the Louisville & Nashville, and has an order for 500 box cars for the Cincinnati, Jackson & Mackinaw. It is bidding for 1,000 box cars for the Northern Pacific.

The Haskell-Barker Car Co., of Michigan City, has an order for 300 box cars for the Iowa Central.

Track Material.—The Louisville & Nashville Ry. Co. has made a contract with the Tredegar Iron Works, of Richmond, Va., for spikes; with the Springfield Iron Works for splice bars; and with the Upson Bolt & Nut Co. for bolts.

Dump Cars.—Ryan & McDonald, of Waterloo, N. Y., have put in a large amount of new plant, and are now turning out about 20 side and rotary dump cars per day.

The Baldwin Locomotive Works, of Philadelphia, Pa., will build a 6-story building, 80 x 80 ft., for storing patterns; also a 1-story sand and oil house, 138 x 34 ft. The buildings will be fireproof and will cost about $75,000.

Boilers.—The Abendroth & Root Mfg. Co., of 28 Cliff St., New York, reports sales of the Root sectional safety boiler to the Atlas Paper Co., of Appleton, Wis., 175 H. P.; 600 H. P. to S. George, Wellsboro, W. V.; 900 H. P. to the Remington Paper Co., Watertown, N. Y.; and a new plant to G. L. Jaeger, of New York City.

Engines.—The Westinghouse Machine Co., of Pittsburg, Pa., reports its business in engines as very good; the orders for May aggregated 82 engines, making 4,500 H. P., of which 2,200 H. P. was for compound engines. Two more engines have been sold to the Council Bluffs Electric Light & Power Co., a third compound engine to the Baldwin Locomotive Works, and a compound engine to the electric light company at Hayward, Cal.

Steam Plant.—The plant of the Claus Spreckels sugar refinery, at Philadelphia, Pa., consists of 30 Babcock & Wilcox boilers, which are located on the first and second floors of the building. Each boiler is fired by a pair of Rooney mechanical stokers, making 60 stokers in all. The stoker plant, together with the complete coal conveying apparatus, is put in by Westinghouse, Church, Kerr & Co., of New York, and is so arranged that the coal is handled mechanically, and without manual labor, from the time the car of coal is dumped until the ashes are shot into the ash vault. Mr. Spreckels has contracted for 31 Westinghouse engines as a part of the power plant; 15 of these engines, each of 60 H. P., are for driving the centrifugal dryers, each engine being coupled direct to its own dryer, dispensing altogether with line shafting.

The Troy Public Works Co. has been organized to succeed the firm of Sherman & McDonough, contractors, West Troy, N. Y. President, R. W. SHERMAN; Treasurer and Secretary, M. MCDONOUGH.

The Mount Vernon Bridge Co., of Mount Vernon, O., is now under the management of W. A. AIKEN, formerly with the Morse Bridge Co.; W. H. PRATT, formerly with the Edge Moor Bridge Co., is Superintendent; and J. T. WAINWRIGHT, formerly with the Pittsburg Bridge Co., is Engineer.

Silica-Graphite Paint is a product put on the market by the Jos. Dixon Crucible Co., of Jersey City, N. J. It is warranted to stand extreme cold and changes of temperature, cannot be touched by rust, and is proof against the influence of salt air. It is three times the bulk of white-lead and twice that of mineral paint, weight for weight, and is guaranteed by the makers to cover fully twice the surface of either class of paints. It comes in all shades from slate to a jet black. It is as good for iron as for wood, and well-attested letters show it as lasting on tin roofs, in excellent condition, for 15 years. The price, ready mixed, varies from $1.30 to $1.50 per gall., in quantities ranging from 5 to 50 galls.

Tie Plates and Frogs.—The Keystone Wrecking Frog, manufactured by the Dunham Mfg. Co., of Boston, Mass., is giving excellent satisfaction. Owing to increased facilities for its manufacture, the price has recently been materially reduced. A number of roads have just placed trial orders with this company for the Servis tie plate; managers are investigating its merits, and a number of roads that have had the plate in use for some time past, and subjected it to critical tests, are contemplating using large quantities in the immediate future.

BRIDGES AND CANALS.

Bridge Notes.—*Newark, N. J.*—The Lehigh Valley R. R. Co. will build a new bridge over the Morris canal for the Bridge Committee, at a cost of $2,200.

Sunbury, Pa.—The two bridges between Sunbury and Northumberland, belonging to the old Northumberland Bridge Co., are to be sold, with the franchises.

West Chester, Pa.—The Chester County Commissioners will build 1 iron and 2 wooden bridges.

Williamsport, Pa.—The contract for replacing the Market St. bridge has been awarded by the Williamsport Bridge Co. to the Berlin Iron Bridge Co., of East Berlin, Conn. It will be a parabolic truss structure, exactly similar to the one which was washed out after having been three years in service. There will be 5 spans of 200 ft. with a roadway 18 ft. wide.

Williamsport, Md.—The Cumberland Valley Ry. Co. has awarded the contract for its Potomac river bridge to the Union Bridge Co., of New York.

Greenville, S. C.—An iron bridge will be built across the Reedy river.

Milledgeville, Ga.—The contract for the Oconee river bridge has been awarded by the County Commissioners to W. H. Crafts, of Atlanta, at $11,660.

Abbeville, Ga.—The Savannah, Americus & Montgomery Ry. Co. will build an iron bridge across the Ocmulgee river.

Astor, Fla.—The Florida Southern Ry. Co. will build a bridge over the St. John's river.

Belleville, Mich.—The contract for the iron bridge over the Huron river, 2¼ miles east of the city, has been awarded to the Stmih Bridge Co., of Toledo, O., at $3,902.

Bay City, Mich.—The $48,000 bridge bonds have been sold to S. A. Kean & Co., of Chicago, at $50,715.

Riverton, Ill.—The Detroit Bridge & Iron Works have completed the Wabash Ry. bridge over the Sangamon river. There are two spans of 180 ft. 6 ins.

St. Cloud, Minn.—The $80,000 bridge bonds have been sold to B. Lake Bros., of New York, at $5,433 premium.

Sioux Falls, Dak.—The contract for the Sixth St. bridge over the East Sioux river has been awarded to the King Iron Bridge & Mfg. Co., of Cleveland, O., at $4,700 for superstructure only.

Bismarck, Dak.—A pontoon bridge is projected similar to the one at Sioux City, Ia.

Kansas City, Kan.—The County Commissioners have appropriated $60,000 for the construction of the Eighth St. bridge across the Kaw river. Plans and specifications are being prepared, and the contract will be let in August.

Kansas City, Mo.—Contracts have been awarded as follows by J. F. O'FLAHERTY, County Surveyor: Front Ave. bridge, Kansas City Bridge & Iron Co., $2,445; abutments, A. Keating, $7,750. Little Blue bridge, Leavenworth Bridge Co., $1,280; piers, $6 per cu. yd.

Del Rio, Tex.—A company is being organized to build an iron bridge across the San Felipe river.

Canadian City, Tex.—The Berlin Iron Bridge Co., of East Berlin, Conn., has the contract for an iron bridge over the Canadian river.

The Pennsylvania Railroad has let contracts for the construction of 3 new arched stone bridges over the Little Conemaugh river, Pa., to replace the 2 old iron plate girder bridges and the old stone viaduct, which were destroyed by the recent flood. Two of these new bridges will be 150 ft. in length each, one of two spans, wide enough for a double track, and the other for three tracks. The old stone viaduct at Viaduct Station, which was built at the time of the original construction of the Pennsylvania Central Railroad main line, is to be rebuilt with 2 spans of stone semicircular arches, 60 ft. high, over the Conemaugh river. Contracts have been awarded as follows: the Lewiston bridge across the Juniata to M. P. Roberts; the Granville bridge to the New Jersey Steel & Iron Co.; May's bridge and the Manayunk bridge to Cofrode & Saylor. The new South Fork and Conemaugh bridges will be of stone.

The Louisville & Nashville Railroad is improving its bridges and replacing wooden with iron or steel structures. The bridge across Licking river is to have two spans, each 163 ft. in length, and the masonry work has already been begun. On the St. Louis division, where the largest of the bridges will be built, the new steel structure over the Wabash will have 5 spans, each 180 ft. in length, all of steel or iron. At Muldraugh's Hill two bridges will be built, each 600 ft. in length. At Rolling Fork, on the main stem, another large structure will be replaced by an iron bridge. It will have two spans, each being 163 ft. in length. These are the larger structures to be built, but the company has let the contracts for the renewal of 10 or 15 others, ranging in length from 40 to 200 ft. The contracts are divided between the Louisville Bridge & Iron Co.; the Detroit Bridge Co., of Detroit, Mich.; the Shiffler Bridge Co., of Pittsburg, and the Phœnix Bridge Co., of Phœnixville, Pa.

Canal.—*Chesapeake & Ohio.*—The contract for repairing the Georgetown level has been awarded to Becker & Blundor, of Georgetown, D. C.

Viaducts.—*Kansas City, Kan.*—The plans for the proposed viaduct on Bridge street over the Missouri Pacific Ry. Co's. yards in Kansas City, Kan., has been completed. The cost of the structure, according to the estimate of City Engineer BOEKE, will foot up to $32,000. The viaduct will be 24 ft. wide, with an addition of 6 ft. for foot walks, and about 488 ft. long not including the approaches, which will be 240 ft. at each end.

Denver, Col.—Work has been commenced on the 16th St. viaduct.

Denison, Tex.—The city will appropriate about $5,000 towards a viaduct over the Missouri, Kansas & Texas tracks.

ELECTRICAL.

Electric Light.—*Bangor, Me.*—The contract for an electric light plant of 165 lights capacity has been awarded to the Brush Co., at $25,909. The plant will be operated by water power.

Dedham, Mass.—The Dedham Electric Light Co. has been awarded a contract.

Springfield, Mass.—The Boston & Albany station will be lighted by the Edison System; the plant will be driven by 2 Westinghouse compound engines, of 65 H. P., coupled directly to the shafting.

Hamburg, N. Y.—The new land company proposes to put in an electric light plant.

Moorestown, N. J.—A contract for plant has been made to the Thomson-Houston Co., at $12,834; there will be 2 compound engines, of 60 H. P. each, a 150 H. P. boiler, and 2 dynamos of 650 lights each.

McKeesport, Pa.—A contract for lighting the city has been awarded to the Edison company; Stern & Silverman, of Pittsburg, will put up the poles and wires.

Lexington, Ky.—The Citizens' Electric Light & Power Co., capital stock, $100,000, will put in a plant.

Hyde Park, Ill.—An electric lighting contract has been made with the Thomson-Houston Co.

Faribault, Minn.—The City Council has accepted the proposition of the Thomson-Houston Electric Light Co. to furnish arc lights on the streets at $100 each per year. The company will at once proceed to put in a plant.

Walsenburg, Col.—The Walsenburg Electric Light & Power Co. has put in an Edison system with 500 lights of 15 c. p. The company has an exclusive franchise.

Plattsmouth, Neb.—An electric light company has been organized. Capital stock, $30,000.

Denison, Tex.—The Thomson-Houston Co. will put in a plant shortly. Power will be furnished for a street railway to Sherman.

Woodland, Cal.—The trustees have contracted with the electric light company for 13 arc lights at $8 per month each.

Hamilton, Ont.—There is considerable discussion over the question of city lighting.

Electrical Subways.—The Standard Electrical Subway Co. has been incorporated at Albany, N. Y., by JOHN J. WILSON, EDWARD B. HOLSTED, and HARVEY L. KENNEDY. Capital stock, $250,000. The principal office is in New York.

WATER AND MUNICIPAL.

Protection from Anchor Ice.—An automatic screen to protect inlets from the entrance of impurities and from the cutting off of the supply by anchor ice, has been patented by J. G. FALCON, submarine diver and contractor, of 116 Dearborn St., Chicago, Ill. Air is pumped into the well or trap at the mouth of the inlet, and rising to the surface, passes out through the screen against the inflow of water; for extensive water supplies a cylindrical screen is placed in the well, with buckets attached, which are inverted over the air supply, so that the air drives the cylinder and then escapes through the cylinder as above; a scraper may be attached to remove any ice or other substances not removed by the air. For further particulars address J. G. FALCON or T. M. NELSON, at the above address.

Cleveland, O.—The Water-Works Trustees have issued their report for 1888. It is stated that the new tunnel can be completed by April, 1890. There are now 256 miles 3,239 ft. of low service pipe, 19 miles 476 ft. of high service pipe, 2,894 hydrants and 5,591 gates; also 1,525 meters and 27,516 services. The total amount of water pumped was 8,491,691,152 galls. at the Division St. station, and 127,324,650 galls. for the high service district. JOHN WHITELAW is Superintendent and Engineer.

Bradford, Pa.—The Water Commissioners have presented their report for 1888. In March a leak caused 25 ft. of the bank to be washed away; the break was repaired and the dam strengthened for its entire length. There are 83,402 ft. of pipe and 202 gates. C. J. LANE is Superintendent.

Negaunee, Mich.—The City Recorder, in his report for the year ending March 19, states that 7,559 ft. of pipe were laid; there are now 9 miles, 628 ft. of mains and 32 hydrants.

Winsted, Conn.—The report of the water-works has been presented for the year ending May 1, 1889, giving details of expenses, receipts, etc.

Amsterdam, N. Y.—The Water Commissioners have presented their report for the year ending April 30, 1889. During the year 4.656 miles of pipe were laid, 54 hydrants and 57 gates set; making a total of 19.776 miles of pipe 194 hydrants and 200 gates. The contract for the river crossing was let at $3.60 per lin. ft. Contracts for pipe and castings were let to the Donaldson Iron Co., of Emaus, Pa., at $26.71 per ton and 2¾ cts. per lb. and to Charles Miller & Son, of Utica, N. Y., at $25.75 and 2¼ cts. A. H. DEGRAFF is Superintendent and Engineer.

Middletown, Conn.—The Water Commissioners have issued their report for 1888. During the present year it is proposed to lay 2 620 ft. of 3, 4 and 6-in. mains. There are now 18.25 miles of pipe and 103 hydrants. W. F. BURROWS is Superintendent.

La Crosse, Wis.—The Board of Public Works has issued its report for 1888. During the year 12,218 ft. of pipe were laid and 35 hydrants set; there are now 99,719 ft. of pipe and 172 hydrants. The total amount of water pumped was 810,230,724 galls. There were 2,238.9 ft. of sewers built, and there are now 3.06 miles of sewers, 50 manholes and 82 catch basins.

New Bedford, Mass.—The Water Board has presented its report for 1888. The question of waste is touched upon, and it is stated that the meter charges are so low that consumers can afford to use the water without restraint. The distributing reservoir has been improved. During the year 27,055 ft. of mains were laid, and 1,586 ft. removed, 48 hydrants and 74 stop gates set there are now 59.2 miles of pipe, 445 hydrants, 615 gates and 108 meters. The total consumption was 1,229,841,794 galls. There are tables of rainfall and engine performance, and a summary of statistics in the form suggested by the New England Water-Works Association. Mr. R. C. P. COGGESHALL is Superintendent.

Newton, Mass.—Mr. ALBERT F. NOYES, City Engineer, has presented his report for 1888. A stone arch bridge, with 3 arches of 21 ft. span and 4 ft. rise, is being built; and the Boston Bridge Works have a contract for an iron bridge on masonry abutments at Washington St. Details are given of the work done, and the cost of the same. The rules of the Board of Health are given in full.

Zanesville, O.—The Trustees of the Water-Works have issued their report for the year ending April 1, 1889. The amount of water pumped was 1,063,662,097 galls. During the year 9,259 ft. of pipe was laid and 13 hydrants set; there are now 44 miles 122 ft. of pipe. R. M. SAUP is Superintendent, and F. KIMBERLY Assistant Superintendent.

Rockford, Ill.—The Superintendent, JOHN T. LAKIN has issued his report for 1888. The total amount of water pumped was 716,651,741 galls. The supply is pumped direct from artesian wells.

Waltham, Mass.—The Water Commissioners have issued their report for 1888. During the year 11,123.8 ft. of pipe were added, making a total of 36 miles 2,302.9 ft., there are 23 miles 2,478 ft. of services. A summary of statistics is given, in the form suggested by the New England Water-Works Association. GEO. E. WINSLOW is Superintendent.

Peabody, Mass.—The Water Board has issued its report for 1888. During the year, 2,942½ ft. of pipe were laid and 5 hydrants set; there are now 135,654½ miles of pipe. A new sluice is to be built and the dam repaired. The total amount of water pumped was 251,851,540 galls.

Newport, Ky.—The Trustees have issued their report for 1888. At the reservoir a part of the work has been done for changing the effluent system. There are 26.89 miles of pipe, and 89 meters. B. R. MORTON is Engineer and Superintendent.

Medford, Mass.—The Water Commissioners have issued their report for the year ending Feb. 1, 1889. The supply of water has been ample, and of excellent quality. There were in January, 38 miles, 2,743½ ft. of pipe 184 hydrants, 294 valves and 11 meters. R. M. Gow is Superintendent.

Sewers.—*Gloucester, Mass.*—Mr. E. W. BOWDITCH, C. E., of Boston, will make surveys and report upon a system of sewerage.

Lowell, Mass.—The Committee on Sewers has awarded the contracts for building the Hudson, Washington, Oakland, Garnet, White and London St. sewers to Edward Cawley, the lowest bidder.

Superior, Wis.—Mr. RUDOLPH HERING, C. E., of New York, has made a report upon the general features of a sewer system, and has been instructed to prepare complete plans.

Greeley, Col.—It is proposed to incorporate a sewerage company. The object is to sewer the city through its main alleys and charge a moderate price for tapping the same and a yearly rental for the use.

Portland, Ore.—An ordinance has been passed authorizing the construction of the Johnson creek sewer.

Helena, Mont.—The second issue of sewerage bonds, for $130,000, have been sold to N. W. Harris & Co., of Chicago, Ill., at $7,725 premium.

Hastings, Neb.—A vote will be taken July 16, on the proposition to issue $75,000 in bonds for a sewerage system.

Grand Island, Neb.—The contract for the new system of sewers has been awarded to Phillips & Stanley, a local firm, at $33,247.50. The engineers are ROSEWATER & CHRISTY, of Omaha.

Fort Worth, Tex.—The city engineer is making surveys for 13 miles of sewers on the Waring system in the western part of the city. There are now 11 miles in use.

Louisville, Ky.—City Engineer SCOWDEN has prepared plans and specifications for the sewer extensions; the work will cost $300,000.

Middleborough, Ky.—The Middleborough Town Co. will put in a system of sewers.

Pontiac, Mich.—Plans for the new sewerage system have been prepared by Mr. PARKER, C. E.

Water-Works.—*Maine.*—Ellsworth. It is proposed to obtain a supply of water from Branch Pond stream, and pump it to a reservoir of 800,000 to 1,000,000 galls. capacity, or a stand-pipe of 300,000 galls. capacity. About 7½ miles of pipe would be required, Mr. B. R. CLARKE, the engineer, estimates the cost at $67,672.

Connecticut.—Windsor Locks. A. C. Hawkins & Co., of Springfield, Mass., have commenced on their water-works contract. The stand-pipe will be 110 ft. high and 20 ft. diameter. Mr. DUNHAM (of Dunham & Paine, Cleveland, O.) is the engineer in charge.

New York.—Brooklyn. At a meeting on July 1, the Board of Aldermen adopted a resolution authorizing the Commissioner of City Works to carry out the work, according to the plans already prepared by Mr. VAN BUREN, for the extension of the water supply system from Rockville Centre to Massapequa Pond, including a conduit from Baldwin's Pond to the Ridgewood pumping station. For this work $4,500,000 will be appropriated. —Syracuse. Mayor KIRK has appointed the Water Commissioners as follows: JAMES B. BROOKS, WM. H. WARNER, CHAS. HUBBARD, WM. K. NIVER, PETER B. MCLENNAN and HENRY J. MOWRY.—Silver Springs. Work has been commenced.—Malone. The new works are completed. Water is brought from a spring 7 miles distant direct to the distribution system of 12, 8, 6 and 4-in. pipes; there is a reservoir of 3,000,000 galls. capacity, which will be used only in case of emergency.—Amsterdam. Superintendent DEGRAFF is making surveys for an additional water supply.—Richmondville. The dams of the 2 reservoirs above the city are to be examined.

Pennsylvania.—Kutztown. The Kutztown Water Co. has been incorporated by S. D. KUTZ, CHAS. MILLER, J. D. SHARIDIN and J. S. TREXLER, of Kutztown, and R. B. KINSEY and PETER D. WARNER, of Reading.

Maryland.—St. Michael's. Water-works are projected; the supply to be taken from artesian wells. For particulars address H. C. DODSON.—Cumberland. New and larger mains are needed to furnish an adequate supply to the west side.

North Carolina.—Statesville. Water-works are projected, and correspondence from contractors is invited. Population, 4,000. For particulars address the mayor. D. A. MILLER.

South Carolina.—Columbia. A pipe will be laid to connect the reservoir with the Congaree river; cost, $5,000.—Orangeburg. The water-works built by Mr. CORNELSON were tested June 24, with satisfactory results.

Georgia.—Washington. Water-works are projected. For particulars address the mayor.

Alabama.—Florence. John C. Martin, of Xenia, O., is negotiating for the contract to build the water-works. —Girard. The water company of Columbus, Ga., has been asked to extend its pipes across the river to this place.

Tennessee.—Erin. It is proposed to obtain a water supply from a spring 1½ miles distant.—Manchester. Mr. J. E. Thomson has ordered machinery for the new works.—Nashville. The Board of Public Works will receive bids until Aug. 1 for a pumping engine of 15,000,000 galls. daily capacity.—Knoxville. Water-works are projected for South Knoxville.

Kentucky.—Danville. Water-works are projected by the town trustees.—Shelbyville. Proposals are invited for building works. Address LYNN T. GRUBER.—Georgetown. Work has been commenced by Nichols & Patterson, the contractors.

Ohio.—Cleveland. There are 275 miles of water pipe in use, and 24 miles of pipe will be laid this year. There are 28,000 in water connections, 1,700 of which are metered. The income water rates this year will be $420,000. A new tunnel, 9,200 ft. long, is being built under the lake to furnish an additional supply of pure water, at a cost of $750,000.

Illinois.—Pinckneyville. The town has made a proposition to the General Manager of the Cairo Short Line to pay for the water privilege of Breeze Lake for a term of 12 years and contribute $6,000 toward the construction of the works, allowing the Short Line to use the water, provided the repair shops are located here.

Iowa.—Missouri Valley. Proposals are invited for building water-works. There will be a reservoir of 1,000,000 galls. capacity, a brick station 26 x 60 ft., a compound duplex pumping engine of 500,000 galls. daily capacity; 3 miles of 4 to 12-in. pipe, and 15 hydrants. Address J. S. WATTLES, City Engineer.

Minnesota.—Adrian. Water-works are to be built, at a cost of $10,000.—St. Paul. The Water Board has laid 15 miles of pipe this year and will lay 15 miles more.

Nebraska.—Fremont. The City Council wants bids for $35,000 water-works extension bonds.

Montana.—Helena. The city is advertising for bids for furnishing a supply of water for 15 years; the bids will be opened Aug. 1. Mr. Geo. F. Wooiston has made a proposition to furnish a supply and put in 200 hydrants if the city will agree to pay $20,000 a year for 20 years.—Bozeman. The works are under construction. Mr. Gray, of Chicago, is the contractor for the reservoir. About 3½ miles of pipe are laid.—Great Falls. The works are being built, the supply will be pumped from the Missouri river. Mr. Ira Myers is at the head of the company, which has a 15 years' contract with the city.

Missouri.—St. Charles. Since the failure of the big water tank, the St. Charles Water Co. has been pumping the supply direct into the mains; the plan works well, and it may be some time before the new tank is built.

Texas.—Alvarado. The St. Louis, Kansas & Texas Ry. Co. will build a reservoir of 31,000,000 galls. capacity.—Bastrop. The Bastrop Improvement & Investment Co. will build water-works. President, J. C. BUCHANAN. Capital stock, $100,000.—Denison. The Denison Land & Investment Co. will build water-works.—Meridian. Water-works are projected. For particulars address the mayor.—Tyler. The water company will put in 50 additional hydrants.

Colorado.—Erie. The town reservoir gave way recently, and the flood caused some damage to adjacent farms.

Oregon.—Ashland. Bonds of $50,000 are to be issued to build water-works. The water will be piped from mountain springs 10 miles distant.

Washington Territory.—Tacoma. The present water-works and water supply are inadequate, and several propositions and applications for franchises have been made. —Seattle. A 2-in water pipe is being laid through the burned district of the city.

California.—San Diego. The San Diego and Coronado water-works have been sold to the New Mexican Land &

Colonization Co., of Boston, Mass., which is controlled by an English syndicate. E. S. BABCOCK, of the Coronado hotel, will remain as manager. Vice President BENSON, of the Chicago, Kansas City and St. Paul Ry. Co., is at the head of the enterprise. The price paid was $1,330,000.—San Bernardino. The City Engineer has prepared an estimate of the cost of the works to be built by the city: 12-in. mains, 10 and 8-in. feeders, 6-in. laterals, $97,000; pipe laying, etc., $55,000; total, $142,000.

Ontario.—Toronto. New proposals for pumping engines will probably be advertised for.

Special Reports of Water-Works.

Brewer, Me.—F. A. FLOYD, Secretary, has sent the following:

The works will be extended to and in South Brewer. For this purpose 18,000 ft. of 6 and 4 in. pipe has been purchased. There will be located on this extension 10 hydrants.

The Weirs, N. H.—We are indebted to IRVING A. WATSON, Concord, N. H., for the following:

The Weirs Water Co. propose to build works costing from $15,000 to $20,000. Water will be pumped to a reservoir from Lake Winnepisseogee. The permanent population is about 100, but the summer population ranges from 1,000 to 10,000. Capital for construction has been secured by private subscriptions for stock, provided the town of Laconia rents a number of hydrants. Address IRVING A. WATSON, or Dr. G. P. CONN, both of Concord.

Cottage City, Mass.—The mains will be extended 1,300 ft. this season, to afford fire protection to Narragansett.

Grafton, Mass.—A 1,000,000-gall. pump and a 65 H. P. steel boiler have been contracted for. Two artesian wells will be sunk for use in dry weather.

Holyoke, Mass.—E. P. CLARK, Registrar, informs us that the storage reservoir, now being built on Whiting St. brook, will have a water area of 114 acres, and that the dam will contain about 11,000 cu. yds. of stone.

Hudson, Mass.—The mains will be extended about 6,000 ft.

Mansfield, Mass.—One mile of extensions to the mains will be made.

Randolph, Mass.—About 2 miles of mains are now being laid.

Greenwich, Conn.—The company is building a large iron storage tank, 2 miles from the reservoir. It will have a capacity of 1,250,000 galls., and be 80 ft. in diameter by 35 ft. high.

Willimantic, Conn.—About 1,325 ft. of 6-in. pipe will be laid this season.

Canton, N. Y.—D. H. RICE has sent the following:

The village has voted to build works. Water will be pumped from Grass river to a stand-pipe. Contracts will be let about July 18, and the works finished November 1. No engineer has been appointed, nor has capital for construction been secured. D. H. RICE is President, and ED. ALDRICH Treasurer, of the organization having the matter in charge. Estimated cost, $40,000. Population, 2,500.

Cazenovia, N. Y.—The following is from CHAS. M. POTTER:

No definite arrangements for water-works have been made, but should a franchise be granted the necessary stock subscriptions could be secured. C. W. KNIGHT, Rome, N. Y., is engineer. The proposed supply is driven wells, with pumping to an iron tank. Estimated cost, $25,000. Population, 2,100.

Gloversville, N. Y.—W. E. LEARING, City Clerk, has sent us the following:

The contract for an extension to the water-works was recently awarded to the lowest bidders, Moore & Shaler, of New York, at $48,500. There were 8 other bidders, the highest figures being $50,079, from J. B. DOYLE, Cohoes.

The work includes a 1,000,000 gall. reservoir on Rice creek, 250 ft. above the corner of Main and Fulton Sts., also a pipe line 16,450 ft. long, of 18, 16, 14 and 12-in. pipe.

Johnstown, N. Y.—About 8,000 ft. of mains and 12 hydrants will be added this year.

Jordan, N. Y.—S. L. ROCKWELL, Superintendent, has given us the following:

The village has granted a franchise to a New York company, but construction has not been started. The present works are owned by W. C. RODGER.

Middletown, N. Y.—We are indebted to D. F. SEWARD, Clerk, for the following:

June 13, the tax-payers voted to build a new reservoir at a cost not to exceed $75,000. The bonded indebtedness of the works has been reduced from $154,000 to $136,000.

Pike, N. Y.—We are indebted to JASPER ROBERTSON for the following:

A spring on a hill above the town would furnish a gravity supply for works to cost about $4,000. It is not probable that works will be built until after another disastrous fire. Population, 600.

Schenectady, N. Y.—E. P. ANGELO, Secretary, has sent us the following:

A 5,000,000-gall. Holly-Gaskill high-duty pumping engine, and 2 boilers, 54 by 18 ft., have been bought. The pumping station will be enlarged and about 1 mile of mains added.

Syracuse, N. Y.—D. H. BRUCE, President of the Syracuse Water Co., has given the following information:

The mayor has recently appointed a water board of 6 members to take steps toward providing works to be owned by the city, water to be taken from Skaneateles lake, 17 miles distant. The legal complications now in the way are likely to be overcome soon.

Southampton, N. Y.—Address D. H. VALENTINE, 26 Court St., Brooklyn, N. Y.

Tarrytown, N. Y.—We are indebted to C. L. KALMBACH for the following:

Extensive improvements are being made, consisting of a new supply from an open well, a pump and pump-house, a low-service reservoir, and high-service tank, and the necessary suction and force mains. The well is located in the swamps at East View, 1 mile from the village limits. It will be carried to bed rock, probably a depth of 38 ft. It is 15 ft. in diameter, with 30-in. stone walls in cement. The walls are settled by means of a water jet, which is furnished by pumping water from the well through a hose. Soft spring water has been found, at a temperature of 54°. No swamp water is admitted to the well.

A 12-in. suction main leads to the pumping station, where the Worthington compound condensing pumping engine is located. A 10-in. force main connects the pump with the low service reservoir, and a 6-in. main, with the tank. The reservoir is in excavation and embankment, 120 by 170 ft., by 15 ft. deep. It has a heart-wall 5 ft. thick, with 2 ft. of puddling on the inside. The wet slope is paved, and both slopes are 1½ to 1. The reservoir is about 20 ft. above the pump. The tank is about 73 ft. in diameter and 30 ft. high.

The contractors for the pumping station and tanks are Moore & Shaler, of New York; for the reservoir, —— Merritt, Port Chester; for pipe and pipe-laying, Van Houten & Cumming, New York. On June 26 J. M. WOLBRECHT was elected Consulting Engineer to the Board of Commissioners.

Altoona, Pa.—The extensions for this season are 4,000 ft. of 12-in. pipe and 8 hydrants. About 250 taps will be made.

Mauch Chunk, Pa.—About 1 mile of 4-in. pipe will be replaced by 8-in.

Mechanicsburg, Pa.—We are indebted to ANDREW SEIFERT, Superintendent, for the following:

The company will replace with 10 in. pipe the main now leading 2¼ miles from the reservoir to the town, provided the town will increase the annual hydrant rental from $400 to $1,000. If this is done, the 6-in. pipe will be relaid in connection with the distribution system.

New Brighton, Pa.—About ½ mile of 6-in. mains and 2 or 3 hydrants will be added this season.

Smethport, Pa.—We are indebted to A. B. ARMSTRONG, Secretary and Superintendent, for the following:

The supply will be increased about one-fourth by connecting the mains with another stream. This will require about 1,500 ft. of cast-iron pipe. The dam will be raised 4 ft., which will double its impounding capacity.

Wellsborough, Pa.—The recent floods washed out the dams and pipes at the upper end of the supply main, 11 miles from the town.

Charlottesville, Va.—T. I. WILLIAMS, Superintendent, informs us that about 2 miles of 6 and 4 in. mains are being added, and 6 hydrants.

Clifton Forge, Va.—R. S. WILEY has sent the following:

The Clifton Water Co. has secured a franchise for works, but the railroad company not having contracted for water, the water company claims it cannot afford to build the works. Water would be pumped from Smith's creek. Estimated cost, $10,000. Population, 2,000. The franchise is held by W. C. MOODY and E. M. NETTLETON.

Goodson, Va.—We are indebted to H. E. MCWANE, Lynchburg, Va., for the following:

The works will be finished July 15, with the Glamorgan Co. of Lynchburg, as engineers and contractors. There will be 7 miles of pipe and 40 hydrants. Cost, $30,000. Population, 3,000. The town owns the works.

Green Forest, Va.—A. T. BUCKLEY, President, has sent the following:

The town has just been laid out, and the Buena Vista Co. owns the hotel and water supply for the same. The latter consists of 1¼ miles of pipe, conducting water by gravity from mountain springs.

Lexington, Va.—Some 3-in. pipe will probably be laid, and hydrants added.

South Boston, Va.—The Glamorgan Co., Lynchburg, Va., inform us that they have completed the works to the satisfaction of the village authorities.

Wytheville, Va.—H. E. MCWANE, Lynchburg, Va., has given the following:

The Glamorgan Co., Lynchburg, Va., is building water-works for the town. A 600,000 gall. Worthington pump will lift water to a 1,000,000-gall. reservoir. There will be 3 miles of 6 and 4-in. cast-iron pipe, and 21 hydrants. Cost, $21,000. Population, 2,500. R. TAYLOR GLEAVES, of Lynchburg, is the Engineer.

Bluefield, W. Va.—The works have been accepted by the town. They were built by The Glamorgan Co., of Lynchburg, Va.

Abbeville, Ga.—R. E. STUBBS, Village Clerk, informs us that nothing definite has been done regarding water-works. A stream which would afford an ample supply flows by the village.

Key West, Fla.—The following is from W. C. PARKER:

An experimental well sunk by the Key West Water Supply Co. has been successful, and an 8-in. well will be sunk immediately. Capital for the construction of works has been secured, and proposals will soon be advertised for. Address GEO. W. PARKER, 300 American Central Building, St. Louis, Mo.

Birmingham, Ala.—We are indebted to W. J. MILNER, Superintendent of the Birmingham Water-Works Co., for the following:

It becoming evident that the supply from Five Mile creek would soon be insufficient, about a month ago a contract was made with the city for an additional supply. This is to be pumped from the Cahaba river, 7¾ miles distant, to a stand-pipe, 425 ft. above and 2,700 ft. from the river. From the stand-pipe, water will flow by gravity to a reservoir on Shades mountain, midway between the pumping station and the city. The reservoir will have a capacity of not less than 25,000,000 galls., and its water surface, when full, will not be less than 320 ft. above city datum, and at its lowest stage, not less than 300 ft. above the same. From the river to the stand-pipe, two 20-in. pipes will be laid, and from thence to a point near the city limits, a 30 in. pipe. The latter will be laid for 2,100 ft. in a tunnel passing through Red mountain. The present supply will not be abandoned.

The contract provides that the improvements shall be completed not later than April 1, 1891; also for a total of 200 hydrants at an annual rental of $55 each, after the Cahaba river water is turned on, and meanwhile for a rental of $66.66 each for 15, and $50 each for all additional. Provisions are made for the purchase of the works by the city.

When the new works are completed 15,000,000 galls. a day can be supplied, and total cost of the plant will then be $1,250,000. J. S. WALKER is the constructing engineer. The contractors are: for pump, H. R. Worthington, New York; pipe, Dennis Long & Co., Louisville, Ky.; reservoir, ditch, and tunnel, Dunn Bros & Co.

Eufaula, Ala.—An extension of 2,000 ft. of 6 and 4-in. pipe has been proposed, but not decided upon.

Geneva, Ala.—R. M. GRAY informs us that the reported water-works consist of 2½ and 3-in. driven wells, being put down by citizens.

Chattanooga, Tenn.—The following is from the Chattanooga Water & Power Co.

This company will make a connection with the mains already supplying the city, pumping therefrom to a stand-pipe for private purposes. They propose to run an inclined and a surface railroad, to lay out a park and build a hotel. The water-works are estimated to cost $75,000, and the total outlay will be about $200,000. JNO. R. DEAN is President, F. A. BIRKSTRESSER, Secretary, ROLAND CLOOK, Treasurer and General Manager, and LIME WHITE, Engineer of the Company.

Manchester, Tenn.—We are indebted to J. E. THOMPSON, who proposes to build the works, for the following:

A dam will be built across Duck River, and furnish power to drive pumps. The latter will lift water from a spring 75 ft. below the town to a tank 50 ft. high. The works will cost from $5,000 to $7,000 and the money is ready to pay for them.

Lebanon, Ky.—JNO. RUBEL, Superintendent, has sent the following:

The works will be ready for the final test Oct. 1. The Scovel & Irwin Construction Co., Nashville, Tenn., are the contractors, and J. D. COOK and L. E. CHAPIN are consulting engineers. There will be an 800,000-gall. reservoir, 471 ft. above the pump, and 290 ft. above the city. The pump is a Gordon compound duplex. The supply main is 10 ins. in diameter by 12,000 ft. long, and the 8-in. force main is 8,000 ft. long. Distribution pipes are 10 to 4 ins. in diameter. Cost, $60,000.

Martinsville, Ind.—The following is from T. H. PARKS:

A spring 87 ft. above the village, with a hill on each side suitable for the location of a stand-pipe or reservoir, afford good natural advantages for water-works. Estimated cost, $12,000. Works may be built by the town, or by capitalists, but nothing definite has been done.

South Bend, Ind.—IRA S. SCHROF, Superintendent, has given us the following:

A new 208 H. P. Babcock & Wilcox boiler was placed in June. In 1890 it is probable that an engine will be added to supplement or supplant the water-power; also that 3 miles of cast-iron pipe will be laid, 35 hydrants set and 30 valves placed.

Warsaw, Ind.—W. H. EGGLESTON, Superintendent, has given the following:

A stand-pipe 20 ft. in diameter and 150 ft. high has been proposed. An arc electric lighting plant is run in connection with the water-works, and probably an incandescent plant will be added.

East Saginaw, Mich.—HENRY M. NEWTON, Secretary, informs us that a 12,000,000-gall. horizontal, compound Holly-Gaskill pumping engine will be added this fall to replace the original 2,500,000-gall Holly pump. The total capacity will then be 18,000,000 galls.

Gladstone, Mich.—ALFRED P. SMITH, City Clerk, has sent us the following:

Keating & Sheehan, Detroit, Mich., are building works for the town, and will have them completed September 1. Cost, $35,000. Population, 2,000.

St. Johns, Mich.—CHAS. P. BAKER, Village Clerk, has given us the following:

A. Hovey & Sons, Detroit, Mich., are the contractors for the water-works, the contract price being $24,900, without pumps or buildings. Gordon pumps and Galvin hydrants and valves will be used.

Ypsilanti, Mich.—We are indebted to W. R. COATS, now at Ypsilanti, for the following:

The town is building the works, with W. R. COATS as engineer. They will be completed Sept. 1. The hydrants, valves, and pumps will be from Flower Bros., Detroit; the pipe from the Detroit Pipe Co.; and the tank from the Porter Mfg. Co., of Syracuse, N. Y. The supply will be from a well 30 ft. in diameter by 32 ft. deep. It will be pumped by a 2,000,000-gall. triple water-power pump. The tank will be of iron, 40 ft. in diameter and 27 ft. deep and will soon be duplicated. There will be 11 miles of 10 to 4-in. cast-iron mains and 165 hydrants. The works will cost $100,000. D. L. QUIRK is Chairman of the Water Board. Population, 7,000.

Carlinville, Ill.—F. WM. RAEDER, St. Louis, Mo., has given us the following:

The first franchise granted by the town not having been utilized, a second one was granted to F. WM. ROEDER, Dec. 7, 1888. This franchise is for 30 years, and it renews itself, unless the works are bought by the city.

Water will be pumped to a stand-pipe from Macoupin creek, which has a drainage area of 125 sq. m., mostly woodland. There will be 2 compound Deane pumps, with a combined capacity of 1,750,000 galls., and 2 boilers, each 65 H. P. The stand-pipe is from T. O. Brien & Co., and will be 10 ft. in diameter by 120 ft. high. The American Filter Co., Chicago, Ill., furnishes the filtering plant. There will be 5 miles of 10 to 4-in. mains and 52 hydrants. The annual hydrant rental is fixed at $3,000 for 52 hydrants, and $50 for each additional. The works will be finished in August. The prospects of the company are good, and its officers are: President, W. G. REEVE; Secretary and Manager, F. WM. RAEDER.